Operating Instructions

WIDE RANGE R.C. OSCILLATOR

Type TF 1370

MARCONI INSTRUMENTS LIMITED, ENGLAND

OPERATING INSTRUCTIONS

No. EB 1370 -/1

for

WIDE RANGE R-C OSCILLATOR

TYPES TF 1370 & TF 1370/1

AMENDMENTS, if any, are included at the end of the handbook.

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DRAWINGS	Ref. No.
MAINS INPUT CONNECTIONS DIAGRAM	XD 35551
FUNCTIONAL DIAGRAM	XD 34930
CIRCUIT DIAGRAM	XD 32126 (2 sheets)
COMPONENT LIST	XD 32126 (6 sheets)

TABLE

DECIBEL CONVERSION TABLE ..... Ref. OM G-SUPP dB (2 sheets)

SCHEDULE OF PARTS SUPPLIED

1. One Wide Range R-C Oscillator Type TF 1370, or TF 1370/1, with attached mains lead, and with valves, etc., as under :-

Valves:	Two:	Type 6BW7, Pentodes.
	Two:	Type 3A/167M, Triodes.
	Two:	Type E88CC, Double Triodes.
	One:	Type EF184, Pentode.
	Two:	Type 6BQ5 (EL84), Pentodes.
	One:	Type 5V4G, Full-Wave Rectifier.
	One:	Type 6080, Double Triode.
	Two:	Type 12AX7 (ECC83), Double Triodes.
	One:	Type 5651 (85A2), Voltage Stabilizer.
Semi-conductors:	Two:	Type CTP1109, Germanium p-n-p Transistors.
	One:	Type OC71 (2N105), Germanium p-n-p Transistor.
	One:	Type SX631-V1P1, Silicon Rectifier.
	Two:	Type GEX66, Germanium Diodes.
Lamps:	One:	Arcolectric Type SL160/Red, 110-volt neon indicator.
	One:	Arcolectric Type SL160/Amber, 300-volt neon indicator.
Fuses:	One:	500-mA, cartridge, Anti-surge.
	One:	2-amp, cartridge.
	One:	3-amp, cartridge.

2. One coaxial Free Plug, Type BNC, Transradio Cat. No. BN1/7 (75 ohms); for DIRECT or ATTEN. output connections.

3. One Instruction Book, No. EB 1370 -/1.

The following optional accessories are supplied only if specially ordered :-

(i) Unbalanced to Balanced Transformer Type TM 6221.

(ii) 1-kc/s Band Pass Filter, Type TM 6222.

(iii) X100 Attenuator Pad, Type TM 6454.

(iv) Coaxial Lead, Type TM 4726/136; 36 inches long; for connecting (i), (ii), or (iii) above to the output sockets on the TF 1370 -/1.

DATA SUMMARY

for

Wide Range R-C Oscillator Types TF 1370 and TF 1370/1

Serial Nos. prefixed JA 809, JA 935, 52038 & above

FREQUENCY	
Range:	Sine waves: 10 c/s to 10 Mc/s in six decade bands. Square waves: 10 c/s to 100 kc/s in four decade bands.
Accuracy:	Within ±2% ±1 c/s.
Long Term Stability:	After 1-hour warm-up, drift does not exceed ±0.2% up to 100 kc/s and ±0.5% up to 10 Mc/s over a 6-hour period, including normal supply voltage variation.
Attenuator Reaction (on matched load):	When switching from 1 V to 3 V position, less than: 0.3% shift at 10 Mc/s, 0.03% at 1 Mc/s. When raising oscillator output from 1/10th to full-scale, at 3 V position, less than: 0.5% shift at 10 Mc/s, 0.05% at 1 Mc/s. Shift is less at lower frequencies and lower attenuator settings.
SINE-WAVE OUTPUT	
Range (via attenuator):	1 mV to 3.16 volts e.m.f. at switch-selected source impedances of 75, 100, and 600 ohms unbalanced. Controlled by attenuator in six 10-dB steps, and potentiometer in conjunction with level monitor. Attenuator Accuracy: within ±1 dB overall on resistive load. Outputs from 10 μV to 31.6 mV at 75 and 5 ohms are available by using X100 Attenuator Pad TM 6454.

Range (direct):	Up to 31.6 volts p.d. across loads of 2 kilohms or greater, at frequencies up to 100 kc/s. Two ranges, up to 10 and 31.6 volts, provided by switched potential divider and potentiometer in conjunction with level monitor. Nominal impedances: 650 ohms on 10-volt range, 25 ohms in series with 500 μF on 31.6-volt range.
Response (relative to 1 kc/s):	50 c/s to 100 kc/s: within ±0.25 dB, falling to about -0.5 dB at 10 c/s. 100 kc/s to 10 Mc/s: within ±0.5 dB for outputs up to 1 volt loaded; within ±1 dB for outputs up to 3 volts loaded.
Distortion Factor:	Less than: 0.5% from 100 c/s to 100 kc/s, 1% from 20 c/s to 1 Mc/s, 2% from 1 Mc/s to 4 Mc/s, 5% from 4 Mc/s to 10 Mc/s.
Hum:	Less than 0.1% of full-scale output above 10 mV.

SQUARE-WAVE OUTPUT

Range:	1 mV to 3.16 volts peak via attenuator, and up to 31.6 volts peak direct. Other details as for sine-wave output except that source impedance is increased by 250 ohms at maximum output step of the attenuator.
Response:	As for sine-wave output.
Rise Time:	0.75 μsec or less at full-scale output; 0.4 μsec or less at 1/3 full-scale output.
Sag:	5% approx. in a 2-kilohm load at 10 c/s; can be adjusted to zero by panel preset.
Mark/Space Ratio:	50/50 ±5%; can be adjusted to exactly 50/50 by panel preset.

LEVEL MONITOR

Voltage Scales:	0 to 31.6 and 0 to 10; indicate r.m.s. value of sine wave and peak value of square wave with respect to zero.
Decibel Scale:	0 to -20 with respect to full-scale; also 0-dB reference points indicating 1 volt peak-to-peak sine wave or square wave across a 75-ohm load.
Accuracy:	±3% of full-scale for sine waves up to 1 Mc/s; additional ±2% of reading for square waves, and for sine waves up to 10 Mc/s.

POWER SUPPLY: 200 to 250 volts, or 100 to 150 volts after adjusting internal link, 45 to 65 c/s; 150 watts. Maximum permissible voltage variation: ±7½%. Models supplied ready for immediate 100- to 150-volt use if specified at time of ordering.

DIMENSIONS & WEIGHT:

Height	Width	Depth	Weight
14 in (36 cm)	20 in (51 cm)	11 1/4 in (28.5 cm)	38 lb (17.1 kg)

Unbalanced-to-Balanced Transformer Type TM 6221

CONNECTIONS:	BNC socket for input; terminals for outputs, centre-tap, and earth.
IMPEDANCE RATIOS:	600 ohms to 600, 200, and 150 ohms.
INSERTION LOSS (at 1 kc/s):	0.5 dB approx.
OUT-OF-BALANCE:	Not exceeding 0.2 dB from 150 c/s to 50 kc/s; not exceeding 1 dB at 20 c/s or 100 kc/s.

RESPONSE AT SECONDARY (with respect to 1 kc/s):	±0.2 dB from 150 c/s to 50 kc/s; not below -1 dB at 20 c/s or 100 kc/s.
DISTORTION FACTOR (loaded, and fed by a pure sine wave at 3 volts e.m.f.):	100 c/s to 50 kc/s, not exceeding 0.2%; 70 c/s to 100 c/s and 50 kc/s to 100 kc/s, not exceeding 0.4%.

DIMENSIONS & WEIGHT:

Height	Width	Depth	Weight
$3\frac{1}{4}$ in	4 7/8 in	4 in	$2\frac{1}{4}$ lb
(8.5 cm)	(12.5 cm)	(10.5 cm)	(1.1kg)

1-kc/s Band-Pass Filter Type TM 6222

CONNECTIONS:	Input, BNC socket; output, terminals.
IMPEDANCE:	600 ohms ±10% when terminated by 600 ohms.
INSERTION LOSS (at optimum pass frequency):	Not exceeding 1 dB.
3-dB PASS BAND:	±90 c/s approx.
DISTORTION FACTOR (loaded, and fed by TF 1370):	Not exceeding 0.02%, feeding 250 mV to load; not exceeding 0.1% feeding 1 volt to load.

DIMENSIONS & WEIGHT:

Height	Width	Depth	Weight
$3\frac{1}{4}$ in	4 7/8 in	4 in	$2\frac{1}{4}$ lb
(8.5 cm)	(12.5 cm)	(10.5 cm)	(1.1 kg)

X100 Attenuator Pad Type TM 6454

CONNECTIONS:	Three BNC sockets.
LOSS:	40 dB ±1 dB.
IMPEDANCE:	Input, 75 ohms; outputs, 75 and 5 ohms.

MAXIMUM INPUT:	6 volts.			
DIMENSIONS & WEIGHT:	Height	Width	Depth	Weight
	1 in	3 3/4 in	1 7/8 in	4 oz
	(3 cm)	(9.5 cm)	(5 cm)	(120 gms)

Coaxial Lead Type TM 4726/136

CONNECTIONS:	BNC plug at each end.
IMPEDANCE:	75 ohms.
LENGTH:	36 inches.

1 INTRODUCTION

1.1 GENERAL

The TF 1370 is a general-purpose sine-wave generator covering the frequency range 10 c/s to 10 Mc/s. It also delivers a high-quality square-wave output at frequencies between 10 c/s and 100 kc/s.

The Oscillator is primarily a signal source for measurements and tests on audio and video amplifiers and networks. With its three output impedances - 600, 100, and 75 ohms - it is very suitable for use with transmission lines, filters, attenuators, etc.

Among other applications as a sine-wave generator is that of providing the excitation voltage for a.f. and r.f. bridges. And the quality of the square-wave output also renders the instrument particularly effective for such purposes as rapid testing of audio amplifier bandwidth.

The signal originates in a Wien-bridge oscillator* covering 10 c/s to 10 Mc/s in six decade bands, the top band extending from 1 to 10 Mc/s. A single scale is used for the four lower bands and separate scales for the two upper bands; this gives a total scale length of 105 inches and makes a 1% change in frequency easily discernible. Speed and precision of tuning are reconciled by a dual-ratio control, 3 : 1 for rapid adjustment and 18 : 1 for fine tuning.

1.2 SINE-WAVE OUTPUTS

Outputs from 1 mV to 3.16 volts are available via a switched attenuator covering 60 dB in 10-dB steps. The signal level applied to the input of the attenuator is continuously variable and is monitored by a meter calibrated in open-circuit voltage and decibels. The output impedance can be set to 75, 100, or 600 ohms, as required.

* Patent provisional spec. No. 33189/60.

1.2 (continued)

Low outputs down to 10 μV at 75 or 5 ohms can be obtained by using the X100 Attenuator Pad available as an optional accessory.

High outputs up to 31.6 volts, at frequencies up to 100 kc/s, are delivered at a separate outlet; this output is controlled by a switched potential divider with a continuously variable input, and the meter indicates the voltage across the load. Switching to a higher frequency band during high output operation automatically lights a warning lamp to show that this is not an operative condition.

1.3 SQUARE-WAVE OUTPUTS

Square-wave outputs up to 31.6 volts peak are available at frequencies up to 100 kc/s. The warning lamp facility provided for high-output sine-wave operation also applies for square waves if a higher-frequency band is selected. Output arrangements are similar to those for sine waves except that the meter indicates the peak amplitude with respect to zero, i.e., half the peak-to-peak voltage.

Both sag and mark/space ratio are adjustable by front panel presets. Below 50 c/s, the sag can be adjusted to zero for any particular load; above 50 c/s, one zero setting is valid for all loads. The mark/space preset enables the ratio to be brought exactly to 50/50.

1.4 RACK MOUNTING

The Wide Range R-C Oscillator Type TF 1370/1 is a rack-mounting version of the Type TF 1370 and is supplied, complete with a dust cover, for mounting in a standard 19-inch rack.

1.5 ACCESSORIES

Supplied only if specially ordered, the following accessories extend the facilities of the instrument: an Unbalanced-to-balanced Transformer, a 1-kc/s Band-Pass Filter, a X100 Attenuator Pad, and a 36-inch lead for connecting any one of these items to the instrument.

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1.5 (continued)

The Unbalanced-to-balanced Transformer provides balanced signals at 600, 200, or 150 ohms source impedance, and is for use with sine-wave outputs in a frequency range 10 c/s to 100 kc/s.

The 1-kc/s Band-Pass Filter, in series with the instrument, passes a pure 1-kc/s signal for applications requiring a very pure waveform.

The X100 Attenuator Pad enables the user to obtain reduced outputs down to 10 μV at a source impedance of 5 ohms or 75 ohms, and is for use with sine-wave or square-wave signals at all operating frequencies of the R-C Oscillator.

2 OPERATION

2.1 INSTALLATION

The instrument is normally despatched ready for a 240-volt supply unless otherwise ordered. Before switching on, be sure that the connections on the mains transformer are correct for the supply voltage to be used - see Section 4.2. If the instrument is supplied in a plastic cover, completely remove this to ensure adequate ventilation.

2.2 SWITCHING ON

Connect the power lead to the a.c. supply socket; when not in use, this lead is stowed in the left-hand case-handle recess. Switch ON the SUPPLY switch. The red pilot lamp should glow.

Allow several minutes to elapse for the instrument to warm up. But allow longer, say an hour, when the highest stability is required.

2.3 ADJUSTING FREQUENCY

Turn the RANGE switch to select the frequency band and adjust the FREQUENCY tuning control for the required frequency. The FREQUENCY tuning control has a combined two-ratio drive, allowing quick adjustment to approximately the required frequency, then fine tuning (over one turn of the knob) through the region of the required frequency.

2.4 SETTING OUTPUT VOLTAGE

Turn the OUTPUT VOLTS SELECTOR switch to the appropriate position for the output required. The settings of this switch for the various output conditions available are shown in Table 1.

Notes: (i) If the OUTPUT VOLTS SELECTOR is set to other than the SINE, 3, ATTEN. position and the RANGE switch is turned above 100 kc/s, no output can be obtained. The WARNING CHECK RANGE lamp will then glow.

(ii) The OFF position enables the user to remove the output without switching off the supply or disconnecting the load.

CAUTION D.C. Content in Output. The output coupling capacitor in the R-C Oscillator is, of necessity, a high capacitance electrolytic type. This allows some d.c. leakage which may affect equipment connected to either outlet. The leakage voltage may amount to some 2% of the a.c. output, both at the DIRECT outlet when loaded with 2 kΩ, and at the ATTEN. outlet when matched with 75 ohms.

Surges in Output. When switching the SUPPLY on or off, and when turning the OUTPUT VOLTS SELECTOR, d.c. surges lasting several seconds arise at the outlets. Depending on the switching operation, the surge open-circuit voltage may be up to about twenty times the a.c. output provided by the settings of the SELECTOR and ATTENUATED OUTPUT switches. The output of the R-C Oscillator should be open- or short-circuited temporarily when the load is sensitive and might be damaged.

2.4.1 Direct Output, up to 30 Volts

From the DIRECT output socket a sine wave or square wave of 0 to 10 volts or 0 to 31.6 volts can be obtained, depending on the position of the OUTPUT VOLTS SELECTOR and the SET OUTPUT control.

The meter, calibrated in peak values for square-wave and r.m.s. for sine-wave signals, indicates the voltage across the load at the DIRECT outlet; this voltage is adjusted by the SET OUTPUT control. The source impedance on the 10-volt range is 650 ohms, and on the 30-volt range it is 25 ohms in series with 500 μF. The permissible external loads are shown in Table 1.

As a rule, when a square wave is taken from the DIRECT outlet, a short output cable should be used; a long cable may cause rounding of the square wave owing to loss of higher frequency components.

While the SELECTOR is at a DIRECT position output can be taken simultaneously from the ATTEN. socket. But if the ATTENUATED OUTPUT switch is set to the 1- or 3-volt positions and the ATTEN. outlet is loaded, the meter will indicate incorrectly the voltage at the DIRECT outlet. The output impedance at the ATTEN. socket will be as for SQUARE ATTEN. (see Table 1) for both sine and square waves.

2.4.2 Attenuated Output, 0 to 3 Volts

When the OUTPUT VOLTS SELECTOR switch is turned to the SQUARE, 3, ATTEN. or SINE, 3, ATTEN. positions, the meter and

TABLE 1

OUTPUT VOLTS SELECTOR at:	True Source Impedance	Max. Freq.	Minimum Load	Meter Indicates
SQUARE, 30, DIRECT - for up to 31.6 V across load.	25 ohms in series with 500 μF at DIRECT socket.	100 kc/s	2 kilohms (to avoid sag).	Peak volts at DIRECT socket.
SQUARE, 10, DIRECT - for up to 10 V across load.	650 ohms at DIRECT socket.	100 kc/s	10 kilohms (to obtain 10 V p.d.; but no sag if lower).	
SQUARE, 3, ATTEN. - for up to 3.16 V source e.m.f.	ATTENUATED OUTPUT switch at 3 V: 250 ohms greater than indicated by Z ATTEN. switch.	100 kc/s	2 kilohms (to obtain 3 volts e.m.f.; Z ATTEN switch at 75 ohms).	Peak value of e.m.f. at the source impedance indicated by Z ATTEN. switch.
	ATTENUATED OUTPUT switch at 1 V: 25 ohms greater than indicated by Z ATTEN. switch.	100 kc/s		
	ATTENUATED OUTPUT switch at 300 mV or less: as indicated by Z ATTEN. switch.	100 kc/s		

TABLE 1 Continued

OUTPUT VOLTS SELECTOR at:	True Source Impedance	Max. Freq.	Minimum Load	Meter Indicates
OFF	No signal output available at DIRECT or ATTEN. output sockets, but basic oscillator remains operative. With the ATTENUATED OUTPUT switch turned to its first five positions, the output resistance at the ATTEN. output socket is indicated by the Z ATTEN. switch; when the ATTENUATED OUTPUT switch is in the 1 V position, add to the Z ATTEN. indication 30 ohms; when in the 3 V position, add 300 ohms.			
SINE, 3, ATTEN. - for up to 3.16 V source e.m.f.	ATTENUATED OUTPUT switch at 3 V: 25 ohms greater than indicated by Z ATTEN. switch	10 Mc/s		R.M.S. value of e.m.f. at the source impedance indicated by Z ATTEN switch.
	ATTENUATED OUTPUT switch at 1 V or less: as indicated by Z ATTEN. switch.	10 Mc/s		
SINE, 10, DIRECT - for up to 10 V across load.	650 ohms at DIRECT socket.	100 kc/s	10 kilohms (to obtain 10 V p.d.; but no distortion if lower).	R.M.S. volts at DIRECT socket.
SINE, 30, DIRECT - for up to 31.6 V across load.	25 ohms in series with 500 μF at DIRECT socket.	100 kc/s	2 kilohms (to avoid distortion).	

2.4.2 (continued)

the ATTENUATED OUTPUT switch together indicate the source e.m.f., i.e. the open-circuit voltage at the ATTEN. output socket.

The seven position ATTENUATED OUTPUT switch provides one +10 dB and five -10 dB steps, relative to the 0 dB position on the switch. According to the voltage required, the ATTENUATED OUTPUT switch should be set to the appropriate position. The voltage indicated by each switch position is the maximum e.m.f. obtainable and also the full-scale meter indication for that switch position; depending upon whether the switch position figure commences with 1 or 3, the 10 V or 30 V scale of the meter should be referred to - and the appropriate multiplying factor applied.

Examples: (i) If 80 mV is required, turn the ATTENUATED OUTPUT switch to 100 mV, and adjust the SET OUTPUT control to obtain a reading of 8 on the 10 V meter scale.

(ii) If 240 mV is required, turn the ATTENUATED OUTPUT switch to 300 mV, and adjust the SET OUTPUT control to obtain a reading of 24 on the 30 V meter scale.

Turn the Z ATTEN. switch to give the source impedance required.

When using sine-wave outputs above 500 kc/s, it is recommended that there should be good matching between the instrument, output lead, and load, i.e. the Z ATTEN. impedance setting, the characteristic impedance of the output cable, and the impedance of the load should all have the same value. If the output cable is not matched above 500 kc/s, it may introduce a reactive component in the coupling that will modify the output actually obtained at the load. The effect increases with length of cable.

Example: With the Z ATTEN. switch turned to 600 ohms and using a 3-ft., 75-ohm, coaxial lead to connect a 600-ohm load to the instrument, the output voltage will be reduced by about 0.15 dB at 500 kc/s, and about 3 dB at 7 Mc/s.

It should be noted that it is not possible to obtain a zero meter reading when using square-wave signals.

2.4.2 (continued)

The rise time of the square-wave signal is reduced proportionately with its output amplitude. So for the shortest rise time, the user should preferably set the ATTENUATED OUTPUT switch so that the SET OUTPUT control can be adjusted to give the required output at a low meter reading. Further, to retain the shape of the square wave, the user should endeavour to obtain good matching between the instrument, output cable, and load as recommended above for sine waves over 500 kc/s. (Note that the true source impedance is increased if the ATTENUATED OUTPUT switch is set to 1 V or 3 V - see Table 1.) If it is not convenient to obtain good matching, the output cable should be kept short; say 3 feet or less. Failure to match a longer cable may cause loss in the higher frequency components of the square wave and result in rounding of its shape.

2.5 dB READINGS

2.5.1 Reading Relative dB Levels

The top scale of the front panel meter is calibrated in dB relative to full-scale meter deflection. Changes of voltage reading on the meter scale may therefore be read in decibels by simply subtracting a lower level from a higher level.

When the ATTENUATED OUTPUT switch position is changed, each increment of 10 dB must be added to the relative meter indication obtained. Note any change of meter reading as the switch is turned, and reset the SET OUTPUT control if necessary (in particular, switching to +10 dB only increases square waves by 10 dB if the level indicated by the meter can be maintained).

Examples:

(a) If the meter is first reading 800 mV, corresponding to -2 dB on the scale (with the ATTENUATED OUTPUT switch turned to 1 V) - and then the output is reduced to give a meter reading of 400 mV, corresponding to -8 dB on the scale, the signal reduction is given by the difference between the two dB readings, i.e. (-2) - (-8) = 6 dB signal reduction.

(b) If the meter is first reading 800 mV, corresponding to -2 dB on the scale, with the ATTENUATED OUTPUT switch turned to 1 V, 0 dB - and then the output is reduced to give a meter reading of 40 mV corresponding to -8 dB on the scale, with the

2.5.1 (continued)

switch turned (through 20 dB) to 100 mV, -20 dB, the signal reduction is given by the difference between the two dB indications, i.e.

$$(-2) - \left[(-20) + (-8)\right] = 26 \text{ dB.}$$

2.5.2 Using Standard Video Reference Level

Included on the top scale of the front panel meter are two calibration marks, SQ and SINE, indicating the standard level of 1 volt peak-to-peak in a 75-ohm load (corresponding to 1 volt peak e.m.f. at 75 ohms source impedance).

To obtain this level, set the Z ATTEN. switch to 75 ohms, set the ATTENUATED OUTPUT switch to 0 dB (1 V), and adjust the SET OUTPUT control to obtain a meter deflection to the SQ or SINE mark on the scale according to whether a square- or a sine-wave output is required from the ATTEN. output socket. The standard level will then appear across the 75-ohm load.

If, for example, a signal 7 dB below the standard level is required, adjust the SET OUTPUT control to reduce the meter deflection by 7 dB as read on the meter dB scale (i.e. down to -7 dB for a square-wave output, or to -10 dB for a sine-wave output).

2.6 SETTING UP AUDIO STANDARD OUTPUT

If a sine-wave source is required at the audio standard of 1 mW in 600 ohms, or levels at 10 dB or 20 dB above the standard - the following procedure should be followed :-

1 mW (0 dBm) in 600 ohms

(i) Connect the external equipment to the ATTEN. output socket.

(ii) Turn the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN.

(iii) Turn the Z ATTEN. switch to 600.

(iv) Turn the ATTENUATED OUTPUT switch to 3 V.

2.6 (continued)

(v) Adjust the SET OUTPUT control to give a meter reading of 1.55 volts. (The meter indicates the e.m.f. at 600 ohms source impedance.)

10 mW (+10 dBm) in 600 ohms

(i) Connect the external equipment, via a 600-ohm resistor, to the DIRECT output socket.

(ii) Turn the OUTPUT VOLTS SELECTOR switch to SINE, 30, DIRECT.

(iii) Adjust the SET OUTPUT control to give a meter reading of 4.9 volts. (The meter indicates the e.m.f. at 600 ohms source impedance.)

100 mW (+20 dBm) in 600 ohms

(i) Connect the external equipment, via a 600-ohm resistor, to the DIRECT output socket.

(ii) Turn the OUTPUT VOLTS SELECTOR switch to SINE, 30, DIRECT.

(iii) Adjust the SET OUTPUT control to give a meter reading of 15.5 volts. (The meter indicates the e.m.f. at 600 ohms source impedance.)

Note: As the instrument load under these conditions is 1200 ohms, it is not advisable to obtain a meter reading greater than about 20 volts, otherwise distortion will occur. The normal minimum load is 2 kilohms (see Table 1).

2.7 ADJUSTING SQUARE-WAVE SAG and MARK/SPACE RATIO

The SAG preset control on the front panel enables the user to make readjustments, below about 100 c/s, to minimize the sag on the horizontal top and bottom of the square wave at any particular signal level and load conditions that comply with Table 1.

2.7 (continued)

To make an adjustment proceed as follows :-

(1) Connect the load to the instrument and set its controls to give the required signal output.

(2) Connect an oscilloscope, having a flat response down to d.c. and an input impedance that is large compared with the load, so as to monitor the square-wave signal.

(3) Adjust the SAG preset control to give zero sag of the waveform viewed on the oscilloscope.

Note: At other conditions of load, frequency, and signal amplitude to those used above, there will be a variation in performance, and the user is advised to reset the SAG control as described in Section 4.8.2 in order to restore the instrument to the standard condition as dispatched.

The M/S preset control on the front panel enables the user to readjust the mark/space ratio of the square-wave signal to secure a ratio of exactly 50/50 at a particular frequency.

To make an adjustment, proceed as follows :-

(1) Set the controls of the instrument to give the required frequency.

(2) Connect an oscilloscope, having a response that is flat from d.c. to 1 Mc/s, so as to monitor the output signal.

(3) Adjust the M/S preset control to give exactly the required mark/space ratio of the square wave, viewed on the oscilloscope.

Note: To restore the instrument to the standard condition as dispatched, see Section 4.8.1.

2.8 ACCESSORIES

2.8.1 Unbalanced to Balanced Transformer Type TM 6221

The Unbalanced to Balanced Transformer is for use with sine-wave signals between 10 c/s and 100 kc/s, fed from a 600-ohm source. It facilitates balanced outputs at an impedance of 150, 200, and 600 ohms and has a centre-tapped secondary winding.

An output may be taken from one half of the various secondary windings, i.e. from one terminal of a pair and the centre tap. In these cases, the output impedance will be one quarter of the impedance marked at a particular terminal. The high-frequency response may be slightly worsened.

Example: If an output is taken from one 200 ohms terminal and the C. T. terminal, the output impedance will be 50 ohms - or if taken from one 150 ohms terminal and the C. T. terminal, the output impedance will be 37.5 ohms.

Connect the transformer input socket to the TF 1370 ATTEN. output socket, by means of a coaxial lead fitted with BNC type plugs (e.g. TM 4726/136), and connect the external load to the appropriate terminals on the transformer. Turn the Z ATTEN. switch to 600 ohms, the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN., and adjust the oscillator and the output voltage as described in Sections 2.3 and 2.4.

The centre tap of the secondary winding on the transformer may be connected to its earthed terminal to obtain an output that is balanced with respect to earth or, if this connection is not made, an output may be obtained that is floating or at some d.c. potential with respect to earth; the maximum d.c. potential allowable between the primary and the secondary windings is 200 volts.

The secondary source e.m.f. between the 600 ohms terminals is the same as the e.m.f. indicated by the TF 1370. For other output impedances Table 2 lists the multiplying factor necessary, due to the turns ratio of the transformer, that should be applied to the e.m.f. reading on the front panel meter to obtain the transformer secondary source e.m.f. When the transformer is loaded there is a small insertion loss; approximately 0.5 dB at 1 kc/s.

2.8.1 (continued)

Warning: It is important that d.c. should not be allowed to flow in the windings of the transformer.

TABLE 2

Secondary Source Impedance	Secondary Terminals	Secondary Source E.M.F. - Multiply E.M.F. indicated on TF 1370 by:
600 ohms	600 Ω & 600 Ω	1.0
200 ohms	200 Ω & 200 Ω	0.577
150 ohms	150 Ω & 150 Ω	0.5
50 ohms	200 Ω & C.T.	0.289
37.5 ohms	150 Ω & C.T.	0.25

2.8.2 Band-Pass Filter, 1 kc/s, Type TM 6222

The 1 kc/s Band-Pass Filter is for use with the TF 1370 to give very pure outputs of 1-kc/s sine-wave signals at a source impedance of 600 ohms.

Connect the Band-Pass Filter input socket to the TF 1370 ATTEN. output socket by means of a coaxial lead fitted with BNC type plugs, and the two terminals on the Band-Pass Filter to the external load. Turn the Z ATTEN. switch to 600 ohms, and the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN. Adjust the oscillator frequency to 1 kc/s and the output voltage to the required amplitude as described in Sections 2.3 and 2.4 respectively. If a valve voltmeter is available, this should be connected across the load and the oscillator frequency adjusted for maximum valve voltmeter reading.

Assuming that the load is 600 ohms, a signal voltage, measured across the load, will be about 10% below half the e.m.f. indicated by the front panel meter. If it is required to ascertain the exact signal voltage across the load, proceed as follows :-

2.8.2 (continued)

(i) Turn the ATTENUATED OUTPUT switch to 3 V.

(ii) Adjust the SET OUTPUT control to give a 3-volt meter deflection.

(iii) Connect a valve voltmeter, set to read 1.5 volts, across the load and read the exact voltage.

(iv) The difference between the TF 1370 e.m.f. reading and the valve voltmeter reading, expressed as a ratio, may then be used to determine accurately the voltage across the same load at other, lower, levels.

The filter can be used with the Z ATTEN. switch turned to 75 ohms or 100 ohms, if some worsening of the second harmonic content and a larger insertion loss is acceptable.

Note: The filter should never be used without a terminating load.

2.8.3 X100 Attenuator Pad Type TM 6454

The X100 Attenuator Pad matches the 75-ohm source impedance of the ATTEN. output socket on the TF 1370, and it is suitable for use with sine-wave and square-wave signals at all frequencies within the operating range of the instrument.

The Attenuator Pad has a BNC INPUT socket and two BNC output sockets both giving 100 times e.m.f. attenuation. The input impedance is 75 ohms; the source impedance at one output socket is 75 ohms and at the other it is 5 ohms.

If, for any particular application, a 5-ohm source impedance is required with less attenuation - then the signal from the TF 1370 may be fed into the 75 ohms OUTPUT socket of the Attenuator Pad and the external load connected to the 5 ohms OUTPUT socket. Under these circumstances the e.m.f. attenuation will be 30 times.

Note: The TF 1370 is not a fully-screened signal generator and consequently errors in the signal level, due to leakage, may occur at μV signal levels at the highest frequencies.

3 TECHNICAL DESCRIPTION

3.1 CIRCUIT ARRANGEMENT

The circuits of the Wide Range R-C Oscillator are selected and combined in a number of ways by the panel controls. The Functional Diagram XD 34930 included at the end of the handbook shows how the circuits are employed.

The basic oscillator is a Wien Bridge type utilizing variable capacitance tuning and switched resistance range selection.

For sine-wave outputs up to 3.16 volts, the basic oscillator output voltage is fed direct to a cathode-follower output stage: for all other sine-wave outputs up to 31.6 volts, the oscillator output signal is applied to the output stage via an amplifier.

Square-wave signals are obtained from a Schmitt circuit, which is triggered by the amplified sine-wave from the basic oscillator. Square waves from the Schmitt circuit are applied to the cathode-follower output stage.

The output cathode-follower feeds either the DIRECT output socket or, via an attenuator or a 75-ohm resistor, the ATTEN. output socket.

The attenuator introduces 60-dB attenuation in six 10-dB steps and has a source impedance of 75 ohms.

An output monitor measures the voltage at the input to the attenuator, or across a 300-ohm resistor when the attenuator is not in circuit. The front panel meter is calibrated to indicate either the source e.m.f. at the ATTEN. output socket or the p.d. at the DIRECT output socket.

3.2 CIRCUIT DESCRIPTIONS

The Circuit Diagrams XD 32126 at the end of this handbook should be studied when reading the following circuit descriptions.

3.2.1 Oscillator Circuit

The basic oscillator, containing valves V1 to V4, is a Wien bridge type circuit. One arm of the bridge consists of a capacitor and a resistor in series, which are connected to a second arm consisting of a capacitor and a resistor in parallel.

The series connected capacitor and resistor include the variable capacitor C10 and one of the fixed resistors, R1, R3, R5, R7, R9, or R11; the parallel connected combination contains the variable capacitor C11 and one of the resistors, R2, R4, R6, R8, R10, or R12. A particular pair of resistors is selected by the RANGE switch, SA, for each of the six frequency ranges, and the variable capacitors, C10 and C11, are ganged to provide tuning over each range.

Preset variable resistors and preset variable capacitors are included in the preceding bridge arms to enable the end frequencies of each range to be accurately set.

The second pair of arms of the bridge consist of the thermistor TH1 and the resistor R29.

The out-of-balance voltage developed by the bridge is applied between the control grid of the pentode V3, via the capacitor C20, and the cathode of V3, via the two cathode followers V1 and V2 in cascade.

The output voltage of the pentode V3 is applied - via the cathode follower V4 - directly across the bridge circuit, thus forming the bridge supply voltage, which is maintained constant by the thermistor TH1 controlling the degree of negative feedback.

3.2.2 20-dB Amplifier

At all settings of the OUTPUT VOLTS SELECTOR switch except that giving sine-waves of up to 3 volts, the output signal from the oscillator circuit is fed to the control grid of the first of the two cascade connected sections of the double triode V6. This oscillator signal is taken from the cathode of V4 when the instrument controls are set for square-wave operation; when the required output is sine waves up to 31.6 volts, the oscillator output is taken from the slider of the SET OUTPUT potentiometer, RV8B.

3.2.2 (continued)

The output voltage at the anode of the second triode amplifier is taken to the Schmitt trigger circuit on the first three settings of the OUTPUT VOLTS SELECTOR switch, i.e. for square-wave outputs. On the last two settings of this switch, the output signal from the 20-dB amplifier is fed direct to the grid of the output-stage cathode follower V7, i.e., for DIRECT 10-volt and 30-volt sine-wave outputs.

A resistive negative feedback path, R83 R38, is provided between the anode of amplifier V6B and the cathode of amplifier V6A to ensure good frequency response and low distortion amplifier characteristics. The capacitor C31 employed is to block d.c.

When the RANGE switch is turned to position E or F (100 kc/s to 10 Mc/s) and the OUTPUT VOLTS SELECTOR switch is set for other than sine-wave outputs up to 3 volts, the amplifier is rendered inoperative by removing the h.t. supply from the double triode V6. Simultaneously, a voltage is applied to the WARNING CHECK RANGE panel neon, ILP2, indicating that the user has set the panel controls to an inoperative condition. These circuit arrangements are effected by switches SCj and SAk.

3.2.3 Schmitt Trigger

The output voltage from the 20-dB amplifier is fed to the control grid of V5A in the Schmitt trigger circuit when the OUTPUT VOLTS SELECTOR switch, SC, is turned to the first three clockwise positions, i.e. the SQUARE, 3, 10, or 30 settings.

The Schmitt circuit, containing the two triode sections V5A and B, is triggered by the sine-wave output signal from the 20-dB amplifier. One triode is held conducting while the other triode is non-conducting; the polarity of the sine-wave signal applied to the control grid of the first triode section, V5A, decides which one of the two sections is conducting at any instant. To enable the switching of condition to occur at the precise base line of the sine-wave input voltage, the control grid of the triode V5A is biased by a voltage obtained from the slider of the M/S potentiometer, RV9, which is a preset control accessible at the front panel. The grid of the triode V5A is d.c. coupled to the anode of the triode V6B; R44, the anode load of V6B, forms part of the resistance chain from which the grid bias of V5A is obtained.

3.2.3 (continued)

The preset capacitor C28, connected between the anode of V5A and the grid of V5B, is included to improve the frequency response of the coupling circuit, and is set for the best rise time.

The capacitor C59, connected between the grids of the two triode sections, bucks out any curvature on the negative excursions of the square-wave output signal, particularly at the higher frequencies.

The output from the Schmitt trigger circuit is fed from the anode of V5B to the grid of the cathode follower V7, in the output stage, via the switch SCe, capacitor C30, and resistor R49. The amplitude of the signal is controlled by varying the value of the anode load V5B; this is achieved by the variable resistor RV8A and the resistor R46.

The rise time of the signal at the anode of the second triode, V5B, depends upon the value of its anode load, and reduces proportionately with the output level; so for the best performance, the amplitude of the signal should be adjusted for a front panel meter reading of about $\frac{1}{3}$ of full-scale deflection.

The potentiometer RV8A is mechanically ganged to the potentiometer RV8B in the oscillator circuit, and the combined potentiometers function as the SET OUTPUT control.

The preset SAG control on the front panel, RV10, adjusts the flatness of the horizontal part of the output-signal waveform. This correction, mainly necessary below 100 c/s, is achieved by introducing into the waveform some curvature in opposition to the sag caused by the coupling capacitors following the Schmitt circuit. The correcting circuit consists of the capacitor C32, resistor R46, a part of the SET OUTPUT control RV8A according to its setting, and the variable resistor RV10. The inclusion of RV8A in the SAG control circuit ensures that the horizontal flatness of the waveform is largely independent of the SET OUTPUT control setting, particularly for outputs up to $\frac{1}{3}$ of full-scale front-panel meter indication.

3.2.4 Output Cathode Follower

The output voltage from the basic oscillator, the 20-dB amplifier, or the Schmitt trigger circuit, is fed to the control grid of the output cathode follower V7, depending upon the setting of the OUTPUT VOLTS SELECTOR switch, SC.

3.2.4 (continued)

The shunt-compensated cathode-follower output stage contains two triode-connected pentodes, V7 and V8, connected in series. The lower pentode V8 forms the cathode load of the upper pentode V7. The signal voltage developed across the resistor R50, in the anode circuit of the pentode V7, is fed via the capacitor C35 to the control grid of the lower pentode V8, thus supplementing the output signal at the cathode of the pentode V7. The output stage introduces only an extremely small amount of distortion and has an output impedance of about 15 ohms.

The signal voltage is taken from the cathode of the pentode V7 and feeds the DIRECT or the ATTEN. output socket via the output attenuation networks, according to the position of the OUTPUT VOLTS SELECTOR switch.

3.2.5 Output Monitor

The output monitor circuit, containing the meter M1 and the two diodes MR1 and MR2, functions as a push-pull mean-reading rectifier circuit fed via the cathode follower V9.

The meter scale is calibrated in r.m.s. values for sine waves and peak readings for square waves. The resistor R81 is connected in circuit when measuring square-wave voltages and is short circuited for sine-wave measurements, the circuit having a greater sensitivity to square-wave inputs.

The potentiometer RV11 connected in series with the meter sets the sensitivity of the meter.

The capacitors C43 and C44 provide the necessary a.c. path for the rectifying diodes, and in addition C44 prevents d.c. flowing between the positive cathode of V9 and earth via the diode MR1 and the meter.

The capacitor C45 is included in the circuit to reduce the d.c. leakage current in the capacitor C44, which would normally affect the meter indication. The capacitor C45 charges up through the resistor R60 to near the potential of the cathode of V9, leaving only

3.2.5 (continued)

a small d.c. polarizing potential across the capacitors C43 and C44.

The capacitors C66 and C67 function as by-pass capacitors. They prevent any r.f. currents, which may be induced in the connecting leads, from passing through the meter.

3.2.6 Output Connections

The output voltage from the cathode follower V7 is fed to either the DIRECT or the ATTEN. output socket via attenuation and impedance adjusting networks, arranged according to the position of the OUTPUT VOLTS SELECTOR switch, SC, as follows :-

(i) SINE or SQUARE, DIRECT, 30: The output from the cathode follower V7 is fed via the capacitors C36 and C37, and switch SC, to the DIRECT output socket at a source impedance of 25 ohms. The output monitor measures one tenth of the output voltage, i.e. measures the voltage appearing across the 300-ohm input impedance to the step-attenuator circuit (or the 300-ohm resistor R59) that is connected in series with the resistors R64 and R65. The meter calibration on the lower scale, 0-31.6 volts, indicates the actual voltage at the DIRECT output socket.

(ii) SINE, or SQUARE, DIRECT, 10: The output from the cathode follower V7 is fed via the capacitors C36 and C37, and the switch SC, to the resistor R64. The signal output is taken from the junction R64/R65 and is one third of the voltage from the cathode of V7. The source impedance is 650 ohms. The output monitor measures one tenth of the voltage from V7, i.e. measures the voltage appearing across the 300-ohm input impedance to the attenuator circuit (or the 300-ohm resistor R59) that is connected in series with the resistors R64 and R65. The meter calibration on the centre scale, 0 - 10 volts, indicates the actual voltage at the DIRECT output socket.

3.2.6 (continued)

(iii) SINE ATTEN., 3: The output voltage from the cathode follower V7 is applied via C36 and C37 to the step attenuator network feeding the ATTEN. outlet. The attenuator network includes a chain of six 10-dB sections, which are progressively withdrawn as the ATTENUATED OUTPUT switch, SB, is turned clockwise. At its seventh position, 3 V, SB substitutes a 75-ohm series resistor, R68.

The source impedance at the ATTEN. outlet is selected by the Z ATTEN. switch, SE. When this is set to 75 ohms, the source impedance is the 75-ohm output impedance presented by the stages of the step attenuator except that, if SB is set to 3 V, the 75-ohm series resistor combines with the output impedance of the cathode follower V7 giving a true source impedance of approximately 100 ohms at the outlet. Turning the Z ATTEN. switch to 100 ohms and 600 ohms adds R119, 25 ohms, and R82, 500 ohms, cumulatively in series with the ATTEN. outlet.

The output monitor measures the voltage from the cathode follower V7 and indicates the source e.m.f. in series with the selected source impedance. The meter scales should be read in conjunction with the setting of SB. When SB is set to 3 V, since the monitor indicates the voltage at the point where V7 feeds the 75-ohm series resistor, it therefore indicates the e.m.f. at the selected nominal source impedance, excluding the output impedance of V7.

Resistor R61 and the attenuator stages, or R59, ensure a leakage path for the electrolytic capacitor C36 if the user does not connect a load.

(iv) SQUARE, ATTEN., 3: The output circuit arrangement is the same as that described for SINE, ATTEN., 3 except that the step attenuator network receives its input from C36 and C37 via resistors R64 and R65. The long CR time constant provided by this path is necessary to avoid

3.2.6 (continued)

sag of the square wave. However, the presence of R64 and R65 has the effect of raising the true source impedance at the ATTEN. outlet as the ATTENUATED OUTPUT switch, SB, is turned to positions of high output (see Table 1 in Section 2.4).

The output monitor measures the voltage at the 300-ohm input of the attenuator chain (or across R59) and indicates the source e.m.f. in series with the selected nominal source impedance, excluding R64, R65, and the output impedance of V7.

3.2.7 Regulated H.T. Supply

The power unit, containing valves V10 to V14, supplies an unregulated 380 volts to the output cathode-follower stage and a regulated 300 volts to the remaining stages in the instrument.

The switch sections SCj and SCk apply h.t. to the Schmitt trigger and/or the 20-dB amplifier circuits when outputs other than attenuated sine waves up to 3 volts are required. If at the same time ranges E or F are selected by the front panel RANGE control, the switch section SAk interrupts this arrangement, applying the h.t. instead to the neon indicator lamp ILP2 - WARNING CHECK RANGE.

The double triode V11 has its two sections connected in parallel and functions as a series regulator. The shunt amplifier that controls V11 includes double triodes V12 and V13. The error voltage input to this amplifier is the difference between (i) a fraction of the h.t. potential, obtained from the slider of potentiometer RV12, and (ii) the reference potential developed by stabilizer V14. These two potentials are individually applied to the grids of the two cathode coupled triodes of V13. Any change of h.t. potential applied via RV12 to V13 is reinforced by the other half of V13, which draws its anode current from the resistor chain feeding RV12. The half of V13 to which RV12 is connected is coupled to the cathode of V12B in a cascade arrangement.

The amplified error voltage, appearing across the resistor R100 in the anode circuit of V12B, is fed via the cathode follower V12A to the control grids of the series regulator V11.

3.2.8 Regulated L. T. Supply

The l. t. d. c. to the basic oscillator, V1 to V4, is provided by the regulated l. t. supply circuit.

The secondary LT4 on the mains transformer T1 supplies 12 volts d. c. via the bi-phase rectifiers MR3A and MR3B.

The transistor VT1, controlled by its base/emitter current, introduces variable d. c. resistance in series with the valve heaters supplied.

The 300-volt positive potential, obtained from the stabilized h. t. unit, is applied to the series resistors R98, RV7, R97 and R115 resulting in a positive stabilized reference potential at the slider of the potentiometer RV7, with respect to the negative side of the l. t. supply.

The base and emitter of the transistor, VT3, are connected between the positive side of the l. t. supply and the positive slider of the potentiometer RV7, and see the difference between these two potentials. Any variation in the l. t. supply voltage results in a corresponding variation between it and the potential at the potentiometer slider. A change in the difference voltage results in a corresponding current variation in the base/emitter current of the transistor VT3, which is amplified and applied to the base/emitter circuit of the series regulator transistor VT1, via transistor VT2.

The transistor VT2 is included in the circuit to provide impedance matching in coupling the high-power transistor VT1 to the relatively low-power transistor, VT3.

The Brimistor TH2 is included in the circuit to compensate for variations in the gain of transistors VT1, VT2, and VT3 due to temperature.

4 MAINTENANCE

4.1 FUSES

The circuits of the Wide Range R-C Oscillator are protected by three fuses: a 2-amp fuse FS1, in series with the line supply and connected between the SUPPLY switch and the mains transformer, T1; a 500-mA fuse, FS2, in series with the centre tap on the h.t. secondary winding on T1; a 3-amp fuse, FS3, in series with the centre tap on the LT4 secondary winding on T1. Fuse FS2 is a Mag-Nickel type, which reduces the possibility of surge currents destroying the fuse if the instrument is switched off and on in quick succession.

The three fuses are mounted in retaining clips connected directly to the terminating tags of the transformer windings, and are accessible upon removing the plate at the left-hand side of the rear of the instrument case, or cover. To remove this plate, slacken the 4-BA screw and move the plate upwards and backwards.

WARNING: Before replacing a fuse or removing the rear plate, first make sure that the instrument is disconnected from the supply.

4.2 INPUT SUPPLY VOLTAGE

For reference while reading this section, open out the Mains Input Connections diagram at the end of the handbook.

The supply lead is connected to a 3-way terminating block, mounted on the vertical power unit chassis, marked L, N, and E (corresponding to line, neutral, and earth respectively). Terminals L and N are connected, via the SUPPLY switch and fuse FS1, to the primary windings of the mains transformer, T1. Terminal E is connected to the chassis.

The mains transformer, T1, has two separate tapped primary windings. By means of these windings, the Wide Range R-C Oscillator can be set to operate from supplies in the ranges 100 to 150 volts and 200 to 250 volts, 45 to 65 c/s.

4.2 (continued)

To make an alteration to the connections on the mains transformer, first make sure that the instrument is disconnected from the supply, and then remove the rear plate as described in Section 4.1.

There are two forms of adjustment: (A) linking of the tags on the transformer to make the instrument suitable for one of the voltage ranges, and (B) tap selection for a particular operating voltage within the selected range.

(A) For supplies with the range 100 to 150 volts, the major sections of the two primary windings must be connected in parallel by a link between the tags marked '100/200 V' and 'TAP A', and another link between the tags marked 'TAP B' and '0 V' on the transformer.

For supplies within the range 200 to 250 volts, the two primary windings must be connected in series by a single link between the tags marked 'TAP A' and 'TAP B' on the transformer.

(B) For a particular voltage within either range, adjustment is made by connecting the red and the black sleeved wires to select the tags on the transformer appropriate to the supply voltage.

The Mains Input Connections diagram at the end of this handbook shows two examples (for supplies of 110 volts and 240 volts) of connections on the transformer.

Should the mains supply not correspond exactly to the tappings provided, the instrument should be adjusted to the nearest available combination.

The twisted pair of wires feeding 110 volts a.c. to the neon front-panel indicator lamp from the '+10 V' and the 'TAP A' tags on the transformer should not be disconnected.

4.3 REMOVING CASE OR DUST COVER

To remove the case from a TF 1370 Wide Range R-C Oscillator: place the instrument face downwards on a flat surface; remove the four screws holding the dome feet in position at the rear of the case; and lift the case clear of the instrument, making sure that the mains lead is passing freely through the aperture in the case-handle recess.

To remove the dust cover from a TF 1370/1 Wide Range R-C Oscillator: remove the plate on the back of the dust cover by slackening the 4-BA screw and sliding the plate upwards and backwards; release the mains lead from the slot in the back of the dust cover; remove the four screws at the corners of the back of the dust cover; and pull the dust cover away from the instrument.

4.4 REMOVING THE CHASSIS COVER

To remove the cover enclosing the underside and lower rear half of the chassis: place the instrument face downwards on a flat surface; remove the twelve 4-BA securing screws; and lift the cover away from the chassis.

4.5 REPLACEMENT OF PANEL LAMPS

Before either panel indicator lamp can be replaced, the leads to the lamp must first be unsoldered from its terminating tag strip mounted on the chassis. The securing nut on the lamp to be replaced can then be removed and the lamp assembly withdrawn from its mounting hole in the front panel. Note that the lamps have different voltage ratings.

4.6 WORKING VOLTAGES

The working voltages given in Tables 3, 4, and 5 are representative of the readings to be expected if measurements are made with a meter having a d. c. resistance of 20,000 ohms per volt (e.g. Avometer model 8). Allowance should be made for variations in valve or transistor performance and component values.

The voltages in Table 4 apply when the controls are set as follows : OUTPUT VOLTS SELECTOR switch turned to SQUARE, 30, DIRECT; RANGE switch turned to any of its first four positions.

4.6 (continued)

TABLE 3

Power Supply Voltages

(See introductory paragraph of Section 4.6)

Voltage	Measured across	Reading
H. T. a. c.	Centre tap and either end of h. t. secondary on T1.	390 V a. c.
Unregulated H. T. d. c.	C50	380 V d. c.
Regulated H. T. d. c. (Set by RV12)	C54	300 V d. c.
L. T. 1	LT1 tags on Transformer T1	6.3 V a. c.
L. T. 2	LT2 tags on Transformer T1*	6.3 V a. c.
L. T. 3	LT3 tags on Transformer T1*	5.0 V a. c.
L. T. 4	Centre tap and either end of LT4 secondary on T1*	15.5 V a. c.
L. T. 4 d. c. supply before regulation	C48	14.2 V d. c.
L. T. 4	Negative and positive lines (points e and f on circuit diagram)	6.3 V d. c.
*WARNING:	The secondary windings LT2, LT3, and LT4 are at potentials above the chassis; care should therefore be taken when checking the l. t. voltages.	

4.6 (continued)

TABLE 4

Valve Electrode Voltages

(See both paragraphs of Section 4.6)

Valve	D. C. Voltages (with respect to chassis)								
	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	57		57	63.3	57		300		
V2				220*	58.5		57		
V3	58.5		58.5				210	198	58.5
V4				230*	97				
V5	240		130			290			
V6	165		5.3			107		2.1	
V7			212				355		355
V8			5				209		
V9	43		43			300	300	300	300
V10				385 (a. c.)		385 (a. c.)		410	
V11	265		300	264		300			
V12		265	265	230		265	154	155	
V13	245		86			155	85	86	
V14	85				85				

* The anode voltages of V2 and V4 are set by RV13 and RV14 respectively, see Section 4.8.6.

4.6 (continued)

TABLE 5

Transistor Electrode Voltages

(see introductory paragraph of Section 4.6)

Transistor	Measured between	Reading
VT1 & VT2	VT1 collector and LT4 positive line (point e on circuit diagram)	11.8 V d.c.
VT3	VT3 base and LT4 positive line (point e on circuit diagram)	0.4 V d.c.

Note: The outer casing of the type CTP 1109 transistor is the collector, which is bolted to the heat sink. The heat sink is secured to, and insulated from, the chassis by five stand-off insulators. If for any reason, the heat sink is taken out of the chassis, care must be taken when the heat sink is replaced to ensure that the securing screws, or any part of the heat sink, are not in contact with the chassis, since this will have the effect of connecting the collector to chassis, and will result in an incorrect d.c. l.t. output.

4.7 REPLACEMENT OF VALVES AND TRANSISTORS

All valves and transistors may normally be replaced without special selection. However, (i) if any of the valves V10 to V14, or any transistor, is replaced, reference should be made to Section 4.8.8, (ii) if any of the valves V1 to V4 is replaced, it is advisable to check that the frequency calibration and the valve currents are correct as described in Sections 4.8.5 and 4.8.6.

4.8 PRESET CONTROLS

4.8.1 Mark/Space Ratio

The M/S preset control, on the front panel, enables the user to set the mark/space ratio of square-wave output signals so that a 50/50 ratio is obtained under general conditions (see Section 2.7 for adjustments under particular conditions). To make this adjustment, proceed as follows :-

(1) Connect an oscilloscope, with a response that is flat from d.c. to 1 Mc/s, to the DIRECT output socket.

(2) Turn the OUTPUT VOLTS SELECTOR switch to SQUARE, 30, DIRECT and adjust the SET OUTPUT control to give a meter deflection of about full-scale deflection.

(3) Adjust the M/S control to give a 50/50 ratio of the waveform viewed on the oscilloscope, at 2 kc/s.

In general, immediately after the above adjustment, the mark/space ratio should be 50/50 within about 2% at all frequencies.

4.8.2 Sag

The SAG preset control, on the front panel, enables the user to adjust the R-C Oscillator to ensure minimum sag under general conditions (see Section 2.7 for adjustments under particular conditions). To make this adjustment, proceed as follows :-

(1) Connect an oscilloscope, with a flat response down to d.c. and an input impedance of not less than 20 kilohms, to the DIRECT output socket. There should be no other load on the R-C Oscillator.

(2) Turn the OUTPUT VOLTS SELECTOR switch to SQUARE, 30, DIRECT and the SET OUTPUT control to give a meter deflection of full-scale at a frequency setting of 10 c/s.

(3) Adjust the SAG control to give zero sag of the waveform viewed on the Oscilloscope.

4.8.2 (continued)

After the above adjustment, the sag with a load of 2 kilohms and meter readings down to 1/3 full-scale should not exceed about 5%. The percentage of sag is expressed as the ratio of the amplitude loss at the end of each half cycle to half the total peak-to-peak amplitude of the signal, multiplied by a hundred.

4.8.3 Rise and Fall Time

The rise and fall time of the square-wave signal is adjusted by the preset capacitor, C28, which is situated alongside the Schmitt trigger valve, V5, and is accessible from the top of the chassis. To make an adjustment to C28 proceed as follows :-

(1) Connect an oscilloscope, capable of measuring rise times between 100 and 700 nanoseconds, to the ATTEN. output socket using a 3-ft, 75-ohm, coaxial connecting cable.

(2) Turn the OUTPUT VOLTS SELECTOR switch to SQUARE, 3, ATTEN., the ATTENUATED OUTPUT switch to 1 V, and the Z ATTEN. switch to 75 ohms.

(3) Tune the instrument to any frequency between 10 c/s and 100 kc/s and adjust the SET OUTPUT control to give a meter deflection about 1/3 of full scale.

(4) Adjust the preset capacitor C28 to produce the squarest waveform, viewed on the oscilloscope.

4.8.4 Output Monitor Sensitivity

The sensitivity of the output monitor circuit may be checked and/or adjusted by means of the preset resistor RV11, which is accessible through a hole in the left-hand side of the instrument case, as follows :-

(1) Connect a standardized valve voltmeter, set to read 3.16 volts, to the ATTEN. output socket.

(2) Tune the Oscillator to 2 kc/s, turn the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN., the ATTENUATED

4.8.4 (continued)

OUTPUT switch to 3 V, and the Z ATTEN. switch to 75 ohms.

(3) Adjust the SET OUTPUT control to produce a valve-voltmeter reading of exactly 3.16 volts.

(4) Adjust the preset control RV11, situated on the left-hand side of the chassis, to give a full-scale front-panel meter reading.

4.8.5 Oscillator Circuit Frequency Adjustments

If one or more of the valves V1 to V4, in the basic oscillator, are replaced, it is advisable to check that the frequency calibration is correct and, if necessary, adjust the appropriate preset control shown in Table 6. To make an adjustment proceed as follows :-

(1) Connect a counter, or other accurate frequency determining instrument, having an input sensitivity better than 500 mV and a frequency range 20 c/s to 10 Mc/s to the ATTEN. output socket.

(2) Turn the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN. and the ATTENUATED OUTPUT switch to 1 V.

(3) At each position of the RANGE switch, set the FREQUENCY dial alternately to indicate the two frequencies shown for each range in TABLE 6 and adjust the corresponding preset controls shown in the table so that the frequency of the output is correct.

Note: To some degree, the preset capacitor and resistor for each range are interdependent; both these components should therefore be rechecked after their initial adjustment. Further, if on range F it is necessary to adjust C1, it may also be necessary to adjust C4 as described in Section 4.8.7. Resistors RV1 to RV6 are accessible upon removing the plate over the cut-out in the chassis cover.

4.8.5 (continued)

TABLE 6

RANGE	Preset Component	Frequency
A	RV6	20 c/s
A	C9	100 c/s
B	RV5	100 c/s
B	C7	1 kc/s
C	RV4	1 kc/s
C	C5	10 kc/s
D	RV3	10 kc/s
D	C3	100 kc/s
E	RV2	100 kc/s
E	C6	1 Mc/s
F	RV1	1 Mc/s
F	C1	10 Mc/s

4.8.6 Oscillator Circuit Valve Currents

If either of the valves V2 or V4, in the basic oscillator circuit, are replaced, it is necessary to check that their d. c. operating conditions are correct. If V2 is replaced it may be necessary to readjust the slider potentiometer RV13; if V4 is replaced it may be necessary to readjust the slider potentiometer RV14.

To make an adjustment to RV13: Connect a voltmeter, having a high d. c. resistance and capable of reading about 220 volts (e. g. Avometer model 8), between the anode of V2 (pin 4) and chassis. Adjust the slider on potentiometer RV13 to give a voltmeter reading of 220 volts.

To make an adjustment to RV14: Connect a voltmeter, having a high d. c. resistance and capable of reading about 230 volts (e. g. Avometer model 8), between the anode of V4 (pin 4) and chassis. Adjust the slider on potentiometer RV14 to give a voltmeter reading of 230 volts.

4.8.6 (continued)

Note: After making the above adjustments to preset components RV13 and/or RV14, it is advisable to check that the oscillator frequency calibration is correct as described in Section 4.8.5.

4.8.7 Output Frequency Response (Range F)

The frequency response of the output voltage at frequencies between 1 and 10 Mc/s can be adjusted by the preset capacitor C4. This adjustment affects the oscillator frequency and, if adjustments are made to C4, it may be necessary to readjust the preset capacitor C1 (see Section 4.8.5). To make an adjustment to C4, proceed as follows :-

(1) Turn the RANGE switch to F, the OUTPUT VOLTS SELECTOR switch to SINE, 3, ATTEN., the ATTENUATED OUTPUT switch to 1 V, and the Z ATTEN. switch to 75 ohms.

(2) Connect to the ATTEN. output socket a 75-ohm load, a valve voltmeter set to read about 0.5 volts, and a counter or other frequency measuring instrument capable of measuring between 1 and 10 Mc/s.

(3) Turn the FREQUENCY dial to read 1 Mc/s and note the valve-voltmeter reading.

(4) Turn the FREQUENCY dial slowly to the 10 Mc/s position, noting any difference in the valve-voltmeter reading from that obtained in (3). If this difference reading is greater than ±0.5 dB, adjust C4 slightly.

(5) Check that the oscillator frequency is correct at the 10 Mc/s setting of the dial, and if necessary, readjust C1.

Note: It may be necessary to readjust RV1 with the frequency dial set at 1 Mc/s. The preset components C1, C4, and RV1 are all interdependent and the adjustment of any one of these controls may affect the correct setting of the other two.

4.8.8 Adjustment of Regulated H. T. and L. T. Supply Voltages

Following the replacement of any valve, transistor, or component in the regulated h. t. or l. t. power circuits, it is advisable to check and, if necessary, reset the d. c. output voltages of the circuits as follows :-

(i) H. T. Regulated Voltage

(1) Apply a supply voltage that is exactly the value for which the mains transformer tappings are adjusted.

(2) Connect a voltmeter, set to measure 300 volts d. c., between the cathode (pin 6) of V11 and chassis.

(3) Adjust the preset potentiometer RV12, which is mounted on the chassis beside V10, to obtain a voltmeter reading of exactly 300 volts.

Note: Any adjustments made to the h. t. regulated power unit may affect the l. t. regulated supply voltage; following such adjustments, the latter should therefore be checked.

(ii) L. T. Regulated Voltage

(1) Apply a supply voltage that is exactly the value for which the mains transformer tappings are adjusted.

(2) Check that the regulated h. t. voltage is correctly adjusted, as described in (i) of this section.

(3) Connect a voltmeter, set to measure 6.3 volts d. c., between the two feed-through capacitors, C57 and C62. These two capacitors serve as terminating tags for the two windings on the bifilar-wound choke L2L3, and are mounted on the left-hand side of the chassis. (The feed-through capacitors are fragile and may fracture if care is not exercised when attaching leads.)

(4) Adjust the potentiometer RV7, situated close to the choke L2L3, to obtain a voltmeter reading of exactly 6.3 volts.

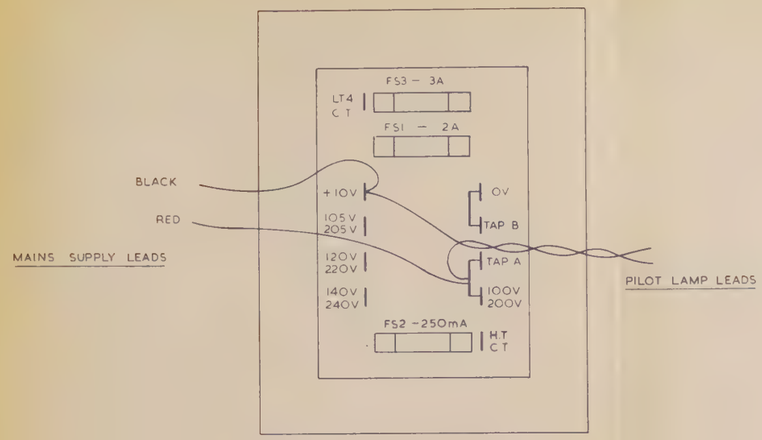


FIGURE 1

CONNECTIONS FOR 110-VOLT MAINS SUPPLY

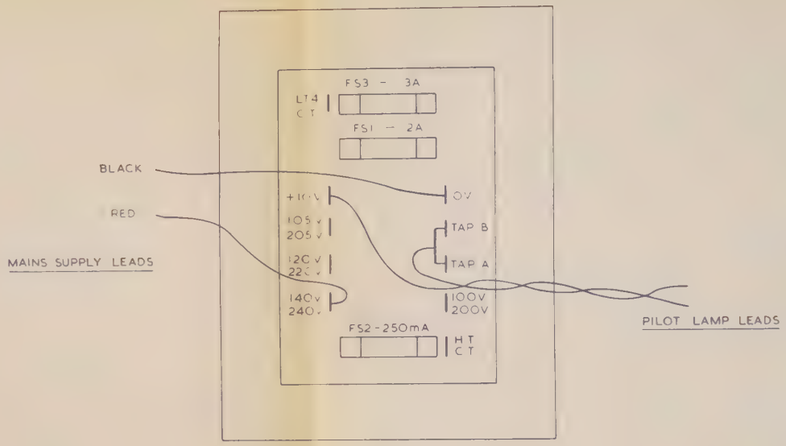


FIGURE 2

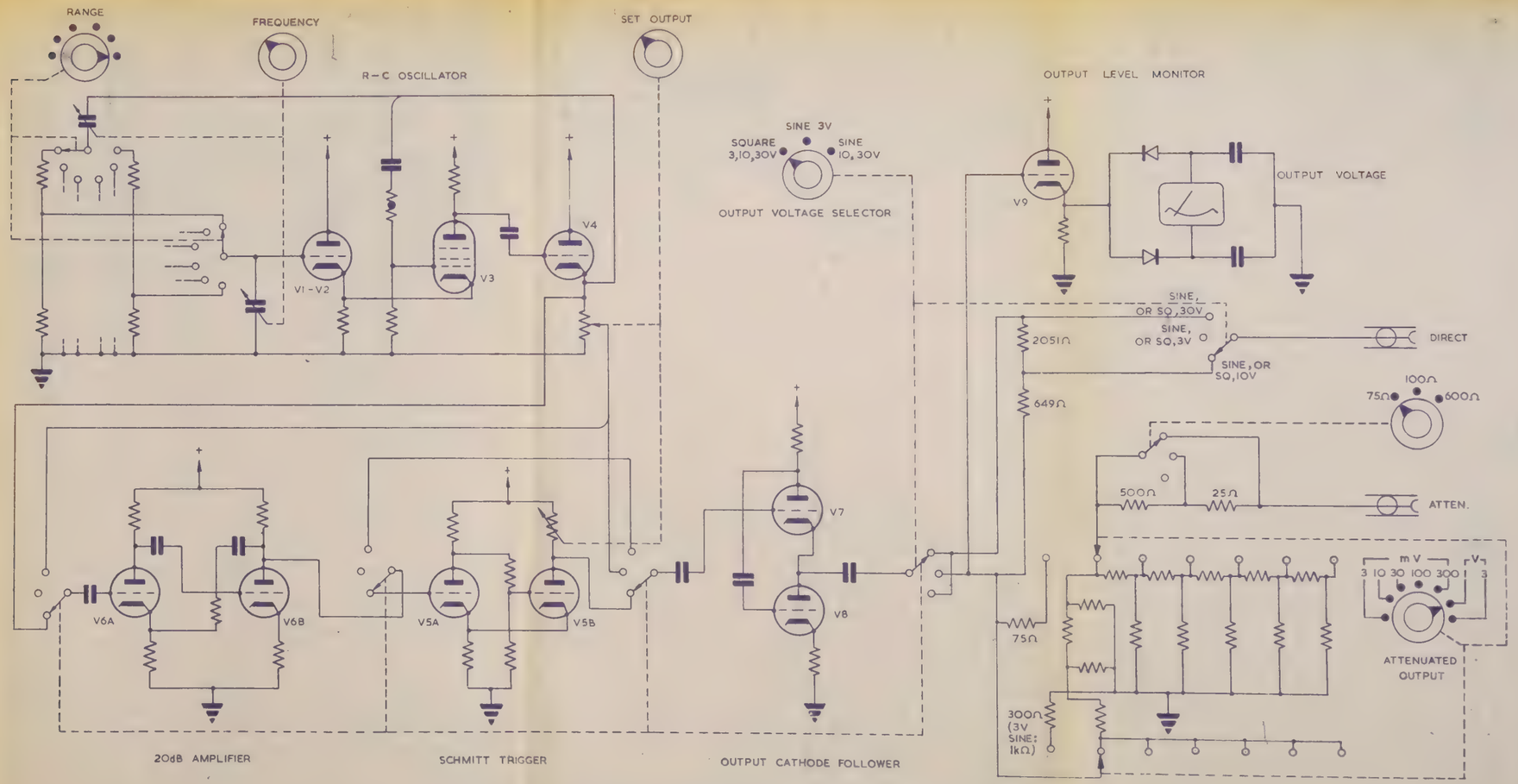
CONNECTIONS FOR 240-VOLT MAINS SUPPLY

TITLE							
MAINS INPUT CONNECTIONS							
DRAWN	DATE	CHKD.	APPD.	TRC.D.	ASSEMBLY	STOCK LIST	DRAWING NUMBER
D. SAULL	4/61			E.M.T			XD 35551
MARCONI INSTRUMENTS LTD.							SHEET 1 OF 1 SHEETS

MAINS INPUT CONNECTIONS

XD 35551

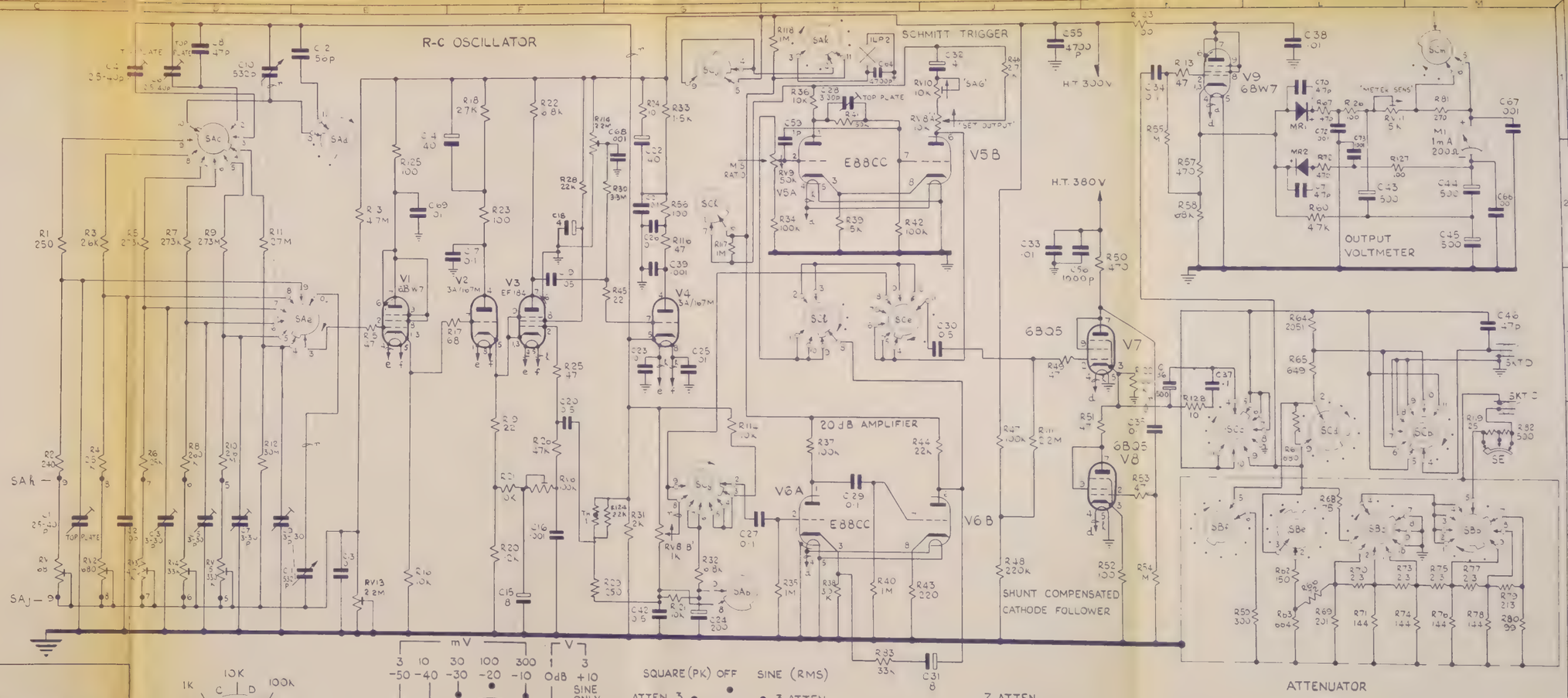
MARCONI
INST. LTD.



FUNCTIONAL DIAGRAM OF WIDE RANGE R-C OSCILLATOR TYPE TF1370

TITLE							
FUNCTIONAL DIAGRAM OF WIDE RANGE R-C OSCILLATOR							
DRAWN	DATE	CHKD	APPD.	TRCD	ASSEMBLY	STOCK LIST	DRAWING NUMBER
M.C.	12-60	J.R.H.		E.M.T.		TF1370	XD 34930
MARCONI INSTRUMENTS LTD.							SHEET 1 OF 1 SHEETS

XD 34930 3

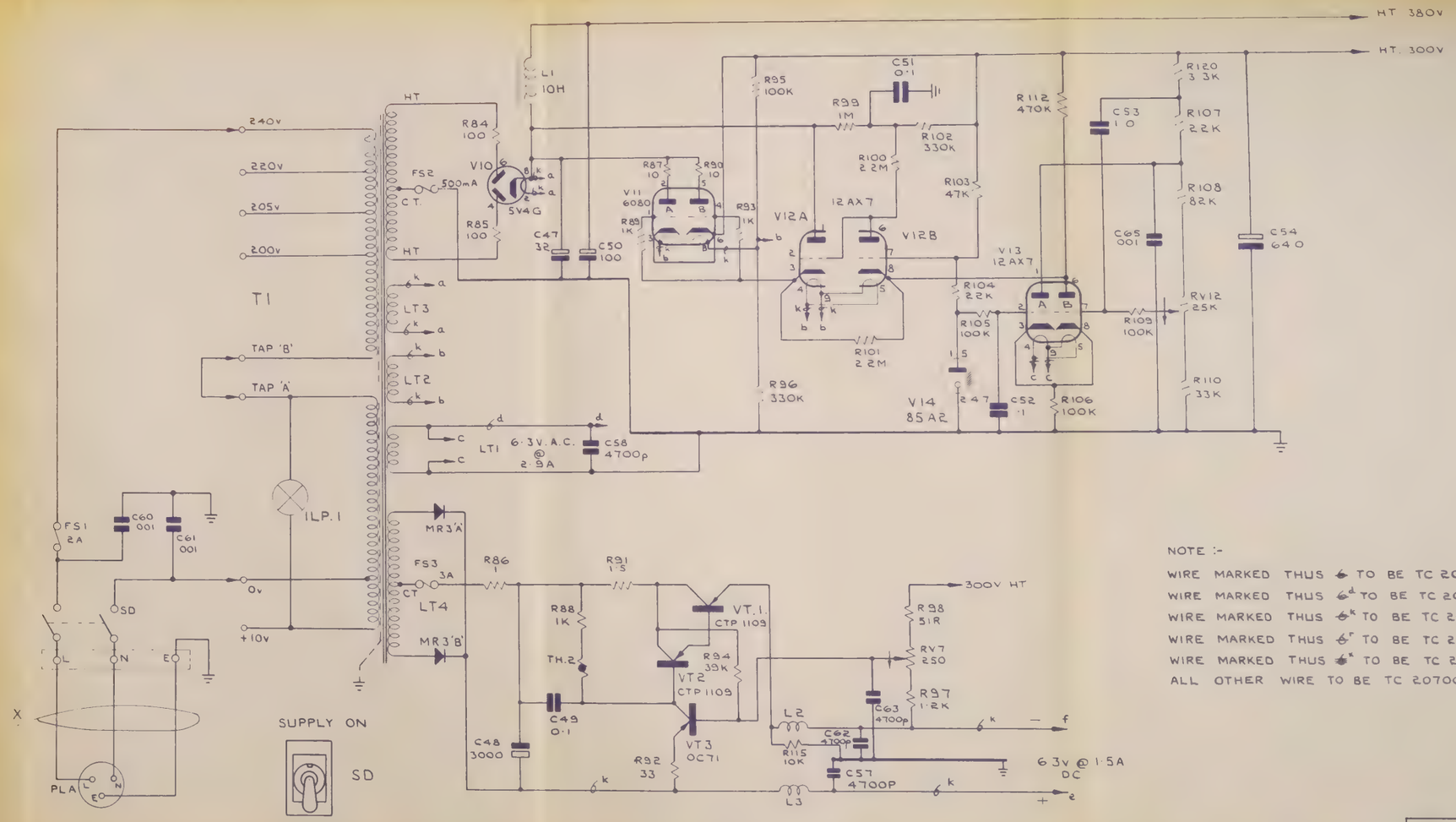


TITLE	WIDE RANGE R-C OSCILLATOR.						
DRAWN	DATE	CHKD.	APPD.	TRCD.	ASSEMBLY	STOCK LIST	DRAWING NUMBER
R.C. CAVE	13·1·60	T.	A.H.	T.D.S.	TE 32098	TF 1370 & /R	XD 32126
MARCONI INSTRUMENTS LTD.							SHEET 1 OF 2 SHEETS

SEE SHEET 2 FOR POWER SUPPLY

XD 32126

24 JUL 1995
MICROFORM



NOTE :-

WIRE MARKED THUS TO BE TC 20700/1.
WIRE MARKED THUS TO BE TC 20700/5.
WIRE MARKED THUS TO BE TC 20700/19.
WIRE MARKED THUS TO BE TC 20700/24.
WIRE MARKED THUS TO BE TC 22092/2.
ALL OTHER WIRE TO BE TC 20700/20.

TITLE.	POWER SUPPLY.						
DRAWN	DATE	CHKD.	APPD.	TRCD.	ASSEMBLY	STOCK LIST	DRAWING NUMBER
R.C.C	20 1 60		A.H.	T.D.S.	TE 32098	TF 1370 & /R	XD 32126
MARCONI INSTRUMENTS LTD.							SHEET 2 OF 2 SHEETS

XD 32126

MARINE
INST. LTD

ISSUE NO. 4

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
	RESISTORS			R27			
[illegible]	250Ω ± [illegible] ¼W	C2 Sh.1	23TM6234	R28	22KΩ ± 5% 2W	G2 Sh.1	107 TF [illegible]
[illegible]	[illegible] ± 1% ¼W	C4 Sh.1	9 TM 6234	R29	250Ω ± 1% ¼W	G5 Sh.1	23 TM 6234
[illegible]	2·6KΩ ± ½% ¼W	C2 Sh.1	10 TM 6234	R30	3·3MΩ ± 10% ¼W	G2 Sh.1	125 TF [illegible]
[illegible]	2·5KΩ ± ½% ¼W	C4 Sh.1	11 TM 6234	R31	2KΩ ± 5% 6W	G5 Sh.1	97 TF 1370
[illegible]	27·3KΩ ± ½% ¼W	C2 Sh.1	12 TM 6234	R32	6·8KΩ ± 10% ¼W	G5 Sh.1	5 TM 6234
[illegible]	[illegible]KΩ ± ½% ¼W	D4 Sh.1	13 TM 6234	R33	1·5KΩ ± 5% [illegible]	G1 Sh.1	98 TF 1370
[illegible]	[illegible]KΩ ± ½% ¼W	C2 Sh.1	14 TM 6234	R34	100KΩ ± 10% ¼W	H2 Sh.1	99 TF 1370
R8	260KΩ ± ½% ¼W	C4 Sh.1	15 TM 6234	R35	1MΩ ± 10% ¼W	H5 Sh.1	100 TF 1370
[illegible]	2·77MΩ ± 1% ¼W	D2 Sh.1	16 TM 6234	R36	10KΩ ± 5% 2W	H1 Sh.1	124 TF 1370
[illegible]	[illegible]MΩ ± 1% ¼W	[illegible] Sh.1	17 TM 6234	R37	100KΩ ± 10% ¼W	H4 Sh.1	99 TF [illegible]
[illegible]	[illegible] ± 2% [illegible]	E2 Sh.1	18 TM 6234	R38	[illegible]9KΩ ± [illegible] ¼W	H5 Sh.1	100 TF [illegible]
[illegible]	[illegible] ± [illegible]	[illegible] Sh.1	19 TM 6234	R39	15KΩ ± 5% [illegible]	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	[illegible] ± 10% ¼W	E2 Sh.1	86 TF 1370	R40	[illegible] ± 10% ¼W	H5 Sh.1	100 TF [illegible]
R14				R41	150KΩ ± 5% ¼W	H1 Sh.1	[illegible] TF [illegible]
[illegible]	[illegible] ± 10% ¼W	[illegible] Sh.1	[illegible] TF 1370	R42	100KΩ ± 5% ¼W	[illegible] Sh.1	105 TF [illegible]
[illegible]	10KΩ ± 10% ¼W	E5 Sh.1	88 TF 1370	R43	220Ω ± 10% ¼W	J5 Sh.1	[illegible] TF [illegible]
[illegible]	[illegible] ± 10% ¼W	F3 Sh.1	[illegible] TF 1370	R44	22KΩ ± 5% 2W	[illegible] Sh.1	107 TF [illegible]
R18	2·7K ± 5% [illegible]	[illegible] Sh.1	90 TF 1370	R45	22Ω ± 10% ¼W	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	22Ω ± 10% ¼W	F4 Sh.1	82 TF 1370	R46	2·[illegible]KΩ ± 10% ¼W	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	[illegible] ± [illegible]	F5 Sh.1	[illegible] TF 1370	R47	100KΩ ± [illegible] ¼W	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	[illegible] ± 10% ¼W	F4 Sh.1	[illegible] TF 1370	R48	220KΩ ± 10% ¼W	J5 Sh.1	[illegible] TF [illegible]
R22	6·8KΩ ± 5% 3W	F1 Sh.1	94 TF 1370	R49	47Ω ± 10% ¼W	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	100Ω ± 10% ¼W	[illegible]	111 TF 1370	R50	47Ω ± 10% [illegible]	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	10Ω ± 10% ¼W	G2	95 TF 1370	R51	47Ω ± 10% ¼W	[illegible] Sh.1	[illegible] TF [illegible]
[illegible]	47Ω ± 10% ¼W	[illegible] Sh.1	[illegible] TF 1370	R52	100Ω ± 10% ¼W	[illegible] Sh.1	111 TF [illegible]
[illegible]	47K ± 10% ¼W	F4 Sh.1	22 TM 6234	R53	47Ω ± 10% ¼W	K4 Sh.1	[illegible] TF [illegible]

DRAWN [illegible]	CHKD [illegible]	USED ON TF 1370	COMPONENT LIST XD32126
DATE [illegible]	APPD.	SHT. 1 OF 6 SHTS.	
TRACED [illegible]	MARCONI INSTRUMENTS LTD.		

ISSUE NO. 4

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
[illegible]	1MΩ ± 10% ¼W	K5 Sh.1	100 TF 1370	R81	270Ω ± 10% ¼W	M1 Sh.1	10 TM [illegible]
R55	1MΩ ± 10% ¼W	K1 Sh.1	100 TF 1370	R82	500Ω ± 1% ¼W	[illegible] Sh.1	113 TF [illegible]
R56	100Ω ± 10% ¼W	G2	111 TF 1370	R83	33KΩ ± 5% ¼W	H5 Sh.1	[illegible]
R57	470Ω ± 10% ¼W	K2 Sh.1	112 TF 1370	R84	100Ω ± 5% 6W	F1 Sh.2	9 TM [illegible]
R58	6·8KΩ ± 10% ½W	K2 Sh.1	84 TF 1370	R85	100Ω ± 5% 6W	F1 Sh.2	[illegible] TM [illegible]
R59	300Ω ± 1% ¼W	L5 Sh.1	8 TM 6233	R86	1Ω ± 10% 3W	F5 Sh.2	[illegible]
R60	4·7KΩ ± 10% ¼W	L2 Sh.1	85 TF 1370	R87	10Ω ± 10% ½W	G2 SHT2	10 TM 6232
R61	680Ω ± 10% ¼W	L4 Sh.1	7 TM 6233	R88	[illegible]KΩ ± 10% ¼W	G5 Sh.2	[illegible]
R62	150Ω ± 1% ¼W	L5 Sh.1	9 TM 6233	R89	1K Ω ± 10% ½W	G2 Sh.2	11 TM [illegible]
R63	664Ω ± 1% ¼W	L5 Sh.1	7 TM 6233	R90	10Ω ± 10% ½W	H2 SHT2	10 TM 6232
R64	2051Ω ± 1% ½W	L3 Sh.1	8 TM 6235	R91	1·5Ω ± 10% 3W	G5 Sh.2	[illegible]
R65	649Ω ± 1% ¼W	L3 Sh.1	9 TM [illegible]	R92	[illegible] ± 10% ¼W	G6 Sh.2	[illegible]
R66	72Ω ± 1% ¼W	L5 Sh.1	6 TM 6233	R93	1KΩ ± 10% ½W	H2 Sh.2	11 TM 6232
R67	470Ω ± 10% ¼W	L1 Sh.1	112 TF 1370	R94	[illegible]KΩ ± 10% ¼W	H5 Sh.2	[illegible]
R68	75Ω ± 1% ¼W	L4 Sh.1	10 TM [illegible]	R95	100KΩ ± 10% ¼W	H1 Sh.2	[illegible]
R69	201Ω ± 1% ¼W	L5 Sh.1	5 TM 6233	R96	330KΩ ± 10% ¼W	H5 Sh.2	[illegible]
R70	213Ω ± 1% ¼W	L5 Sh.1	3 TM [illegible]	R97	1·2KΩ ± 1% ¼W	J5 Sh.2	120 TF [illegible]
R71	144Ω ± 1% ¼W	L5 Sh.1	2 TM [illegible]	R98	51KΩ ± 5% [illegible]	J5 Sh.2	[illegible]
R72	470Ω ± 10% ¼W	L2 Sh.1	112 TF 1370	R99	[illegible]MΩ ± 10% ¼W	H2 Sh.2	[illegible]
R73	213Ω ± 1% ¼W	M5 Sh.1	3 TM [illegible]	R100	[illegible]MΩ ± 10% ¼W	[illegible] Sh.2	[illegible]
R74	144Ω ± 1% ¼W	M5 Sh.1	2 TM 6233	R101	[illegible]MΩ ± 10% ¼W	J1 Sh.2	15 TM [illegible]
R75	213Ω ± 1% ¼W	M5 Sh.1	3 TM 6233	R102	330KΩ ± 10% ¼W	J2 Sh.2	[illegible]
R76	144Ω ± 1% ¼W	M5 Sh.1	2 TM [illegible]	R103	47KΩ ± 5% ½W	[illegible] Sh.2	[illegible]
R77	213Ω ± 1% ¼W	M5 Sh.1	[illegible] TM [illegible]	R104	22KΩ ± 5% ¼W	[illegible] Sh.2	17 TM [illegible]
R78	144Ω ± 1% ¼W	M5 Sh.1	[illegible] TM 6233	R105	100KΩ ± 10% ¼W	[illegible] Sh.2	[illegible]
R79	[illegible] ± 1% ¼W	M5 Sh.1	[illegible] TM [illegible]	R106	100KΩ ± 10% ¼W	[illegible] Sh.2	12 [illegible]
R80	[illegible] ± 1% ¼W	M5 Sh.1	4 TM [illegible]	R107	[illegible] ± 10% ¼W	[illegible] Sh.2	[illegible]

DRAWN [illegible]	CHKD	USED ON TF 1370	COMPONENT LIST XD 32126
DATE [illegible]	APPD.	SHT. [illegible] OF [illegible] SHTS.	
TRACED [illegible]	MARCONI INSTRUMENTS LTD.		

24 MAR 1967
MARCONI

ISSUE NO. 6

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF
[illegible]	[illegible]	[illegible]	20 TM [illegible]	RV6	100K ± [illegible] ¼W	[illegible]	[illegible]
R109	100KΩ ±10% ¼W	[illegible]	12. TM [illegible]	RV7	250Ω ± 10% 2W	J5	[illegible]
R110	[illegible]	[illegible]	[illegible]	RV8A	[illegible]	[illegible]	[illegible]
R111	[illegible] ± 10% ¼W	[illegible]	[illegible] TF [illegible]	RV8B	1K ± [illegible]	[illegible]	[illegible]
R112	[illegible]	[illegible]	[illegible] TM [illegible]	RV9	[illegible]	[illegible]	[illegible]
R113	4[illegible] ± 10% ¼W	[illegible]	[illegible] TF [illegible]	RV10	[illegible]	[illegible]	[illegible]
R114	[illegible] ± 10% [illegible]	[illegible]	[illegible]	RV11	[illegible] ± 20% [illegible]	[illegible]	[illegible]
R115	[illegible]	H6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4[illegible] ± 10% ¼W	[illegible]	[illegible] TF [illegible]	RV13	2·2MΩ ± 20% ¼W	E5 SH.1	131.TF1370
[illegible]	[illegible] ± 10% [illegible]	[illegible]	[illegible] TM [illegible]	RV14	2·2M ± 20% ¼W	F2 SH.1	131.TF1370
R118	[illegible] ± 10% ¼W	H1	[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]				
R120	3·3KΩ ± 10% ¼W	K1 SH.2	23 TM 6[illegible]2		[illegible]		
R121	10K ± 10% ¼W	G5 SHT1	21 TM 62[illegible]4	[illegible]	[illegible]	[illegible]	[illegible]
R122	100KΩ ± 10% ¼W	K3 SHT1	99 TF 1370	[illegible]	[illegible]	[illegible]	[illegible] TF [illegible]
R123	100Ω ± 10% ¼W	[illegible] SHT1	111 TF 1370	[illegible]	[illegible]	[illegible]	[illegible]
R124	2·2Ω ± 10% [illegible]	G4	[illegible] 1370	[illegible]	[illegible]	[illegible]	[illegible]
R125	100Ω ± 10% ¼W	E2 SH.1	111 TF 1370		[illegible]	[illegible]	[illegible]
R126	100Ω ± 10% ¼W	L1 SH.1	111.TF1370	C6	[illegible]	[illegible]	[illegible]
R127	100Ω ± 10% ¼W	L2 SH.1	111.TF1370	C7	[illegible] PART OF [illegible]	[illegible]	[illegible]
R128	10Ω ± 10% ¼W	K3 SHT1	95. TF 1370	C8	47[illegible]	[illegible]	[illegible]
	RESISTORS VARIABLE			C9	[illegible]	[illegible]	[illegible]
[illegible]	[illegible] ± 10% 2W	[illegible]	[illegible]	C10	[illegible]	[illegible]	[illegible] TF [illegible]
[illegible]	[illegible] ± 10% 2W	[illegible]	[illegible]	C11	[illegible]	[illegible]	
RV2	4·7KΩ ± 20% ¼W	[illegible]	[illegible]	C12	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	C13	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	C14	[illegible]	[illegible]	[illegible]

DRAWN A. [illegible]	CHKD	USED ON [illegible]	COMPONENT LIST XD32126
DATE [illegible]	APPD.	SHT. OF SHTS.	
TRACED [illegible]	MARCONI INSTRUMENTS LTD.		

ISSUE NO. 4

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
C15	8μF +100% -20% 100V	F5 SH.1	145 TF 1370	C42	0·5μF ± 20% 150V	G5 SHT1	48 TM 6234
C16	·001μF ± 20% 600V	F4 SH.1	46 TM 6234	C43	500μF +100% -20% 25V	L2 SH.1	17 TM 6235
C17	0·1μF ± 20% 350V	F2 SH1	151 TF 1370	C44	500μF +100% -20% 25V	M2 SH.1	17 TM 6235
C18	4μF +100% -20% 350V	G2 SH.1	146 TF 1370	C45	500μF +100% -20% 50V	M2 SH.1	196 TF 1370
C19	·05μF ± 20% 350V	F2 SH.1	147 TF 1370	C46	47pF ± 10% 750V	M3 SH.1	19 TM 6235
C20	0·5μF ± 20% 150V	F4 SH.1	46 TM 6234	C47	32μF +50% -20% 500V	G2 SH.2	159 TF 1370
C21	0·1μF ± 20% 350V	G2	151 TF 1370	C48	3000μF +100% -20% 25V	G6 SH.2	168 TF 1370
C22	40μF +100% -20% 100V	G2 SH.1	144 TF 1370	C49	0·1μF ± 20% 250V	G6 SH.2	159 TF 1370
C23	·01μF ± 20% 400V	G3 SH.1	146 TF 1370	C50	100μF +50% -20% 500V	G2 SH.2	161 TF 1370
C24	200μF +50% -20% 100V	G3 SH.1	149 TF 1370	C51	0·1μF ± 20% 350V	J1 SH.2	50 TM 6235
C25	·01μF ± 20% 400V	G3 SH.1	148 TF 1370	C52	0·1μF ± 20% 250V	J3 SH.2	51 TM 6235
C26	0·1μF ± 20% 350V	G2 SHT1	151 TF 1370	C53	1μF ± 20% 350V	K1 SH.2	52 TM 6235
C27	0·1μF ± 20% 350V	H4 SH.1	20 TM 6235	C54	16μF +50% -20% 450V	L2 SH.2	162 TF 1370
C28	7-30pF TRIMMER	H1 SH.1	150 TF 1370	C55	4700pF +∞ -0 350V	K1 SH.1	162 TF 1370
C29	0·1 μF ± 20% 350V	H4 SH.1	151 TF 1370	C56	1000pF ± 20% 500V	K2 SH.1	169 TF 1370
C30	0·5μF ± 20% 150V	J2 SH.1	152 TF 1370	C57	4700 pF +∞ -0 350V	J6 SH.1	162 TF 1370
C31	6μF +100% -20% 350V	J6 SH.1	166 TF1370	C58	4700pF +∞ -0 350V	G4 SH.2	162 TF 1370
C32	4μF +100% -20% 50V	J1 SH.1	153 TF 1370	C59	1pF ± 0·5pF 750V	H1 SH.1	164 TF 1370
C33	·01μF ± 20% 400V	K2 SH.1	146 TF 1370	C60	·001 μF ± 20% 600V	P4 SH.2	166 TF 1370
C34	0·1μF ± 20% 250V	K1 SH.1	20 TM 6235	C61	·001μF ± 20% 600V	D4 SH.2	165 TF 1370
C35	0·1μF ± 20% 350V	K4 SH.1	151 TF 1370	C62	4700pF +∞ -0 350V	J2 SH.2	163 TF 1370
C36	200μF +50% -20% 275V	K3 SH.1	154 TF 1370	C63	4700pF +∞ -0 350V	J6 SH.2	162 TF 1370
C37	0·1μF ± 20% 250V	K2 SH.1	155 TF 1370	C64	4700pF +∞ -0 350V	H1 SH.1	162 TF 1370
C38	·01μF ± 20% 400V	L1 SH.1	146 TF 1370	C65	·001μF ± 20% 600V	K2 SH.2	33 TM 6235
C39	·001μF ± 20% 600V	G2 SHT.1	167 TF 1370	C66	·001 ± 20% 600V	K2 SHT1	167 TF 1370
C40				C67	·001 ± 20% 600V	M1 SHT1	167 TF 1370
C41				C68	·001μF ± 20% 600V	M2 SHT.1	167 TF 1370

DRAWN A. CATO	CHKD	USED ON TF 1370	COMPONENT LIST
DATE 5.7.60.	APPD.	SHT. 4 OF 8 SHTS.	XD32126
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ISSUE NO. 4

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
C69	·01μF ± 20% 400V	F2 SH.1.	148 TF 1370		SWITCHES		
C70	4·7pF ± 0·5pF 750V	L1 SH.1.	168 TF 1370	SAB	)	H5 SH.1	
C71	4·7pF ± 0·5pF 750V	L2 SH.1.	168 TF 1370	SAC	)	D1 SH.1	
C72	·001μF ± 20% 600V	L1 SH.1.	167 TF 1370	SAD	)	E1 SH.1	
C73	·001μF ± 20% 600V	L2 SH.1.	167 TF 1370	SAE	5 SEC. 6 POS.	E3 SH.1	1 TM 6234
	VALVES			SAH	)	C4 SH.1	
V1	6 BW7	E3 SH.1	231 TF 1370	SAJ	)	C5 SH.1	
V2	[illegible]	F3 SH.1	232 TF 1370	SAK	)	H1 SH.1	
V3	EF 184	F3 SH.1	233 TF 1370				
V4	[illegible]	G3 SH.1	232 TF 1370	SBb	)	[illegible] SH.1	1 TM 6233
V5	[illegible]	H2 SH.1	234 TF 1370	SBc	1 SEC. 7 POS.	M4 SH.1	
V6	[illegible]	H4 SH.1	234 TF 1370	SBe	)	L4 SH.1	
V7	6BQ5	K3 SH.1	235 TF 1370	SBf	)	L4 SH.1	
V8	6BQ5	K4 SH.1	235 TF 1370	SBh	)	M4 SH.1	1 TM 6235
V9	[illegible]	L1 SH.1	231 TF 1370	SCc	)	L4 SH.1	
V10	[illegible]	[illegible] SH.2	69 TM 6232	SCd		L4 SH.1	
V11	[illegible]	H2 SH.2	[illegible] TM 6232	SCe	6 SEC. 7 POS.	J3 SH.1	
V12	[illegible]	[illegible] SH.2	71 TM 6232	SCg	)	[illegible] SH.1	
V13	[illegible]	K3 SH.2	71 TM 6232	SCj	)	[illegible] SH.1	
V14	[illegible]	J3 SH.2	[illegible] TM 6232	SCk	)	[illegible] SH.1	
				SCl	)	[illegible] SH.1	
				SCm	)	[illegible] SH.1	
	THERMISTORS.			[illegible]	[illegible]	[illegible] SH.2	[illegible] TF 1370
VT1	CTP 1109	H2 SH.2	239 TF 1370	[illegible]	1 SEC. 3 POS.	[illegible] SH.1	[illegible] TF 1370
VT2	CTP 1109	H2 SH.2	239 TF 1370				
VT3	[illegible]	H2 SH.2	240 TF 1370				

DRAWN A. [illegible]	CHKD —	USED ON TF1370	COMPONENT LIST XD 32126
DATE 5.7.60.	APPD.	SHT. 9 OF 6 SHTS.	
TRACED WS	MARCONI INSTRUMENTS LTD.		

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ISSUE NO. 2

CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.	CIR. REF.	DESCRIPTION	GRID	STOCK LIST REF.
	TRANSFORMERS				SOCKETS		
T1	MAINS	F2 SH.2	1 TM 6232	SKT.A			
				SKT.B			
				SKT.C	CO-AXIAL 75Ω	M4 SH.1	182 TF 1370
	METERS			SKT.D	CO-AXIAL 75Ω	M3 SH.1	179 TF 1370
M1	200Ω 1MA F.S.D.	M2 SH.1	2 TF 1370				
	INDICATING LAMPS				RECTIFIERS		
ILP1	110V NEON	E4 SH.2	176 TF 1370	MR1	GEX 66	L1 SH.1	180 TF 1370
ILP2	300V NEON	H1 SH.1	177 TF 1370	MR2	GEX 66	L2 SH.1	180 TF 1370
				MR3A	SX 631, VIP1	F4 SH.2	181 TF 1370
				MR3B		F5 SH.2	
	FUSES						
FS1	2A	F4 SH.2	18 TM5151/13				
FS2	500MA	F2 SH.2	19 TM5151/13		THERMISTORS		
FS3	3A	F5 SH.2	20 TM5151/13	TH1	414	G4 SH.1	114 TF 1370
				TH2	CZ3	G5 SH.2	150 TF 1370
	PLUGS				INDUCTORS.		
PLA	3 PIN 5 AMP.	D5 SH.2	1 TM2550 BG	L1	CHOKE 10H 75MA	G1 SH.2	39 TM 5035
PLB	CO-AXIAL 75Ω		178 TF 1370	L2	CHOKE	H6 SH.2	170 TF 1370
PLC				L3	CHOKE	H6 SH.2	170 TF 1370
PLD							

DRAWN A. CATO	CHKD	USED ON TF1370	COMPONENT LIST XD32126
DATE 5.7.60.	APPD.	SHT. 6 OF 6 SHTS.	
TRACED MC	MARCONI INSTRUMENTS LTD.		

24 JUL 1985
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DECIBEL CONVERSION TABLE

Ratio Down			Ratio Up	
VOLTAGE	POWER	DECIBELS	VOLTAGE	POWER
1·0	1·0	0	1·0	1·0
·9886	·9772	·1	1·012	1·023
·9772	·9550	·2	1·023	1·047
·9661	·9333	·3	1·035	1·072
·9550	·9120	·4	1·047	1·096
·9441	·8913	·5	1·059	1·122
·9333	·8710	·6	1·072	1·148
·9226	·8511	·7	1·084	1·175
·9120	·8318	·8	1·096	1·202
·9016	·8128	·9	1·109	1·230
·8913	·7943	1·0	1·122	1·259
·8710	·7586	1·2	1·148	1·318
·8511	·7244	1·4	1·175	1·380
·8318	·6918	1·6	1·202	1·445
·8128	·6607	1·8	1·230	1·514
·7943	·6310	2·0	1·259	1·585
·7762	·6026	2·2	1·288	1·660
·7586	·5754	2·4	1·318	1·738
·7413	·5495	2·6	1·349	1·820
·7244	·5248	2·8	1·380	1·905
·7079	·5012	3·0	1·413	1·995
·6683	·4467	3·5	1·496	2·239
·6310	·3981	4·0	1·585	2·512
·5957	·3548	4·5	1·679	2·818
·5623	·3162	5·0	1·778	3·162
·5309	·2818	5·5	1·884	3·548
·5012	·2512	6	1·995	3·981
·4467	·1995	7	2·239	5·012
·3981	·1585	8	2·512	6·310
·3548	·1259	9	2·818	7·943
·3162	·1000	10	3·162	10·000
·2818	·07943	11	3·548	12·59
·2512	·06310	12	3·981	15·85
·2239	·05012	13	4·467	19·95
·1995	·03981	14	5·012	25·12
·1778	·03162	15	5·623	31·62

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DECIBEL CONVERSION TABLE

Ratio Down			*Ratio Up*	
VOLTAGE	*POWER*	*DECIBELS*	*VOLTAGE*	*POWER*
·1585	·02512	**16**	6·310	39·81
·1413	·01995	**17**	7·079	50·12
·1259	·01585	**18**	7·943	63·10
·1122	·01259	**19**	8·913	79·43
·1000	·01000	**20**	10·000	100·00
·07943	·006310	**22**	12·59	158·5
·06310	·003981	**24**	15·85	251·2
·05012	·002512	**26**	19·95	398·1
·03981	·001585	**28**	25·12	631·0
·03162	·001000	**30**	31·62	1,000
·02512	·0006310	**32**	39·81	1,585
·01995	·0003981	**34**	50·12	2,512
·01585	·0002512	**36**	63·10	3,981
·01259	·0001585	**38**	79·43	6,310
·01000	·0001000	**40**	100·00	10,000
·007943	·00006310	**42**	125·9	15,850
·006310	·00003981	**44**	158·5	25,120
·005012	·00002512	**46**	199·5	39,810
·003981	·00001585	**48**	251·2	63,100
·003162	·00001000	**50**	316·2	100,000
·002512	$6{\cdot}310 \times 10^{-6}$	**52**	398·1	158,500
·001995	$3{\cdot}981 \times 10^{-6}$	**54**	501·2	251,200
·001585	$2{\cdot}512 \times 10^{-6}$	**56**	631·0	398,100
·001259	$1{\cdot}585 \times 10^{-6}$	**58**	794·3	631,000
·001000	10^{-6}	**60**	1,000	10^{6}
·0005623	$3{\cdot}162 \times 10^{-7}$	**65**	1,778	$3{\cdot}162 \times 10^{6}$
·0003162	10^{-7}	**70**	3,162	10^{7}
·0001778	$3{\cdot}162 \times 10^{-8}$	**75**	5,623	$3{\cdot}162 \times 10^{7}$
·0001000	10^{-8}	**80**	10,000	10^{8}
·00005623	$3{\cdot}162 \times 10^{-9}$	**85**	17,780	$3{\cdot}162 \times 10^{8}$
·00003162	10^{-9}	**90**	31,620	10^{9}
·00001000	10^{-10}	**100**	100,000	10^{10}
$3{\cdot}162 \times 10^{-6}$	10^{-11}	**110**	316,200	10^{11}
10^{-6}	10^{-12}	**120**	10^{6}	10^{12}
$3{\cdot}162 \times 10^{-7}$	10^{-13}	**130**	$3{\cdot}162 \times 10^{6}$	10^{13}
10^{-7}	10^{-14}	**140**	10^{7}	10^{14}

Printed in England SK 10/63 RWT